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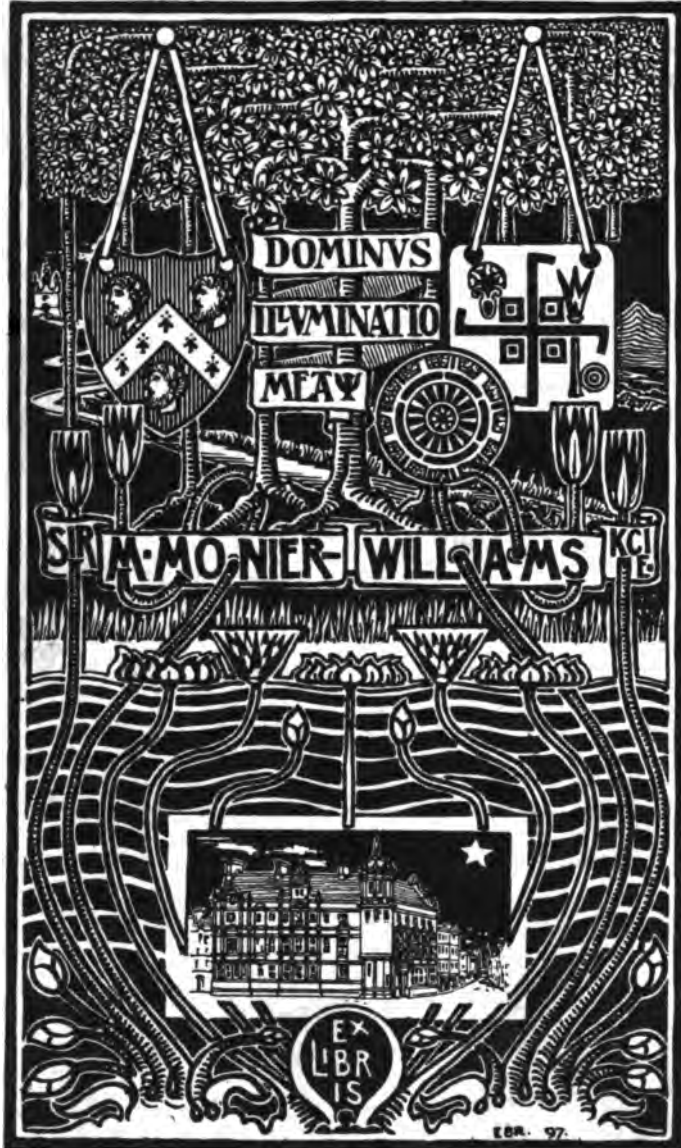
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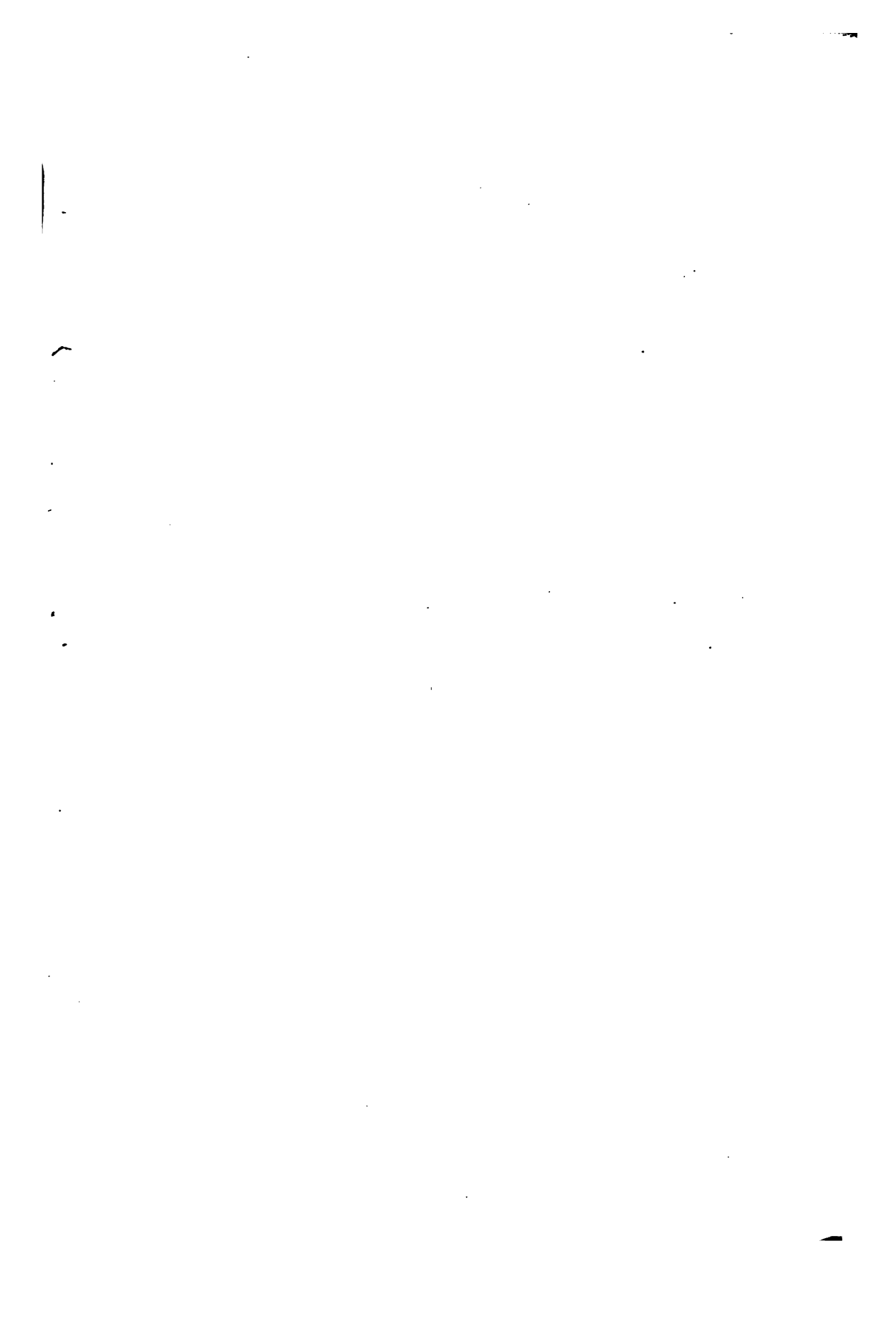
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CORRESPONDENCE
ON THE SUBJECT
OF THE
GEOLOGICAL MAP OF INDIA,
COMPILED BY
PROFESSOR GREENOUGH.

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**MADRAS :**

**PRINTED AT THE ASYLUM PRESS, MOUNT ROAD, BY WM. THOMAS, AND PUBLISHED  
BY CAPTAIN A. H. HOPE, SECRETARY IN CHARGE.**

**1857.**



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DESPATCH FROM THE HONORABLE COURT OF DIRECTORS  
IN THE PUBLIC DEPARTMENT.

No. 49 of 1854.

OUR GOVERNOR IN COUNCIL,  
AT FORT ST. GEORGE.

1. We forward to you a No. in the Packet ten copies of a Geological map of India compiled by Mr. G. B. Greenough from such materials as he has been able to collect and which we think may be made the means of procuring further and more correct information than is now available on a subject which we consider to be one of great interest on both scientific and economic grounds.

2. In order that this object may as far as possible be attained we direct that a copy of the Map be forwarded to such of the Departments under your Government as may be likely to possess information on the subject, and to such individuals as you may believe to be qualified by their acquirements and pursuits to afford assistance with instructions to test the accuracy of the Map by such information as they may possess or may be able to obtain with regard to any particular portions of the country, and to communicate the results marked upon the Maps, which are to be returned to your Government accompanied by a full statement of the grounds on which they may base their conclusions.

3. We are desirous that this information should be obtained with as little delay as is practicable with reference to the time which the officers to be consulted may have to apply to the object, and we should hope, that within twelve months from the receipt\* of this Despatch you may be able to acquaint us with the result. At all events we direct that at the expiration of that period you furnish us with a report of the information already obtained and of the prospect which may exist of further particulars being supplied within a reasonable time.

We are,  
Your loving Friends.

J. OLIPHANT,  
E. MACNAGHTEN,  
W. B. BAYLEY,  
R. ELLICE,  
GEO. POLLOCK,  
R. D. MANGLES,  
J. H. ASTELL,  
J. W. HOGG,  
H. T. PRINSEP,

LONDON, 27th September 1854. C. MILLS.

---

\* 30th November 1854 but the Maps did not arrive till June 1855.

No. 1268.

*Extract from the Minutes of Consultation, dated 28th November 1854.*

The Right Honorable the Governor in Council proceeds to pass orders on a Despatch from the Honourable Court of Directors, dated 27th September, No. 49 of 1854.

General Cullen,  
Surgeon Balfour,  
Dr. Hunter,  
Rev. F. Muzzy.

Forward 10 copies of a Geological Map of India which may be made the means of procuring further and more correct information than is now available with this view direct, that a copy be sent to such of the Departments and individuals as may be likely to afford the information sought, which will be marked on the Maps and returned to Government, accompanied by a full statement of the grounds on which their conclusions are based.

Are desirous that this information be obtained with as little delay as possible, and the result communicated to Honorable Court at the expiration of 12 months from the date of the receipt of this despatch.

Resolved that copies of this despatch and of the Maps referred to, when received, be forwarded to the gentlemen named in the margin—also, to the Revenue and Military Departments, for communication to such Officers as may be qualified for the task, with a request that they will afford all the assistance in their power towards the attainment of the object in view and submit as early as practicable, together with the return of

the Maps with their observations marked thereon, a full report of the nature called for by the Honorable Court.

H. C. MONTGOMERY,  
*Chief Secretary.*

QUARTER MASTER GENERAL'S OFFICE.

No. 144.

From

THE QUARTER MASTER GENERAL OF THE ARMY.

To

THE SECRETARY TO GOVERNMENT,

MILITARY DEPARTMENT.

SIR,

Having now received replies from the different Officers who were addressed to furnish Geological information for Mr. Greenough's Map referred to in the Extract Minutes of Consultation dated 28th November last, No. 1268, I have the honor by order of the Provincial Commander-in-Chief, to forward two Reports from Major Dallas, Deputy Assistant Quarter Master General, Ceded Districts, (who states that he is mainly indebted to Superintending Surgeon Cole for the observations he has recorded); from Col. Græme, Commanding 5th Light Cavalry, regarding Hyderabad and the Deccan; from Captain Burton, Deputy Assistant Quarter Master General Southern Division, as to the countries comprehended within his limits, and a copy of a letter from the Deputy Assistant Quarter Master General, Northern Division, who states, that as far as his information enables him to judge, the entries in the Map are correct. Information in the Saugor Division has been sent direct by Major Jenkins, Deputy Assistant Quarter Master General of that Division.

The Maps which were sent to this Office are herewith returned.

FORT ST. GEORGE, }  
21st May 1856. }

I have, &c.,

F. A. REID,  
*Quarter Master General.*

OBSERVATIONS ON THE GEOLOGICAL FEATURES OF THE CEDED  
DISTRICTS WITH REFERENCE TO MR. GREENOUGH'S MAP  
OF INDIA.

\* 28,593 Square Miles.

The Ceded Districts,\* comprising the Collectorates of Bellary and Cuddapah and the District of Kurnool, are situated between the 13th and 17th degrees of north latitude, and the 76th and 80th east longitude. The general character of the country is an extensive table land, sloping from west to east. The general elevation on the west being from 2,000 to 2,500 feet. Bellary being 1,600, from whence the declination westward continues to the eastern boundary which is about 450 feet. The western ghauts form the anticlinal line to which the arenaceous and schistous eastern ranges are more or less conformable.

2. The aspect of the Ceded Districts presents a vast surface of apparently boundless plains, broken here and there by detached rocky hills and occasional clusters and chains of low elevation. The exception to this general character of the country, are the ranges of the Soondoor, Nulla Mulla and Gurrumcondah Hills.

3. The soils consist of three classes, the Regur, (black), Musub (mixed), and Lal (red.) The former, which in the Bellary District alone covers an extent of one million acres, is from 1 to 12 feet in depth and is mingled with decomposed felspar, gritty particles of quartz, and often covered with angular pebbles of white quartz, ferruginous quartz and jasper. Water is rarely found in these black lands except at a great depth, and villages are few and far apart. In the Cuddapah District the decomposition of the limestone, calcareous veins, clay slate and sandstone, imparts a lighter colour and a looser texture to the regur ; below this soil is generally found a konkrous deposit resembling white gravel, which is found to answer well for metalling roads. An Officer at present employed in superintending the construction of roads in this District was desirous of aiding the enquiry into the origin of the black cotton soil, by making excavations along the line under his charge and furnishing a series of sections extending over a considerable distance. Had time permitted such an investigation, more accurate data would have been obtained, to form a correct opinion regarding the nature of the underlying strata, and some important facts would probably be elicited.

4. The musub or mixed soil is found in all parts of the Ceded District and covers in extent double that of the pure regur.

The lal is hard, gravelly and sterile, seldom cultivated, and often covered with low jungle. In the Bellary District there are about two and a quarter millions of acres of this land.

5. Clay slate and sandstone are found in great abundance in many parts of the Kurnool Territory and parts of the Cuddapah District; and in the limestone and sandstone formation around Cuddapah itself, the late Lieutenant Newbold was of opinion that coal may probably exist. But granite is the principal rock formation in the Ceded Districts; indeed almost every minor hill is composed of it and its associated schists and even the larger ranges have it for their basements, although it is not found in some of them above a certain elevation.

6. Dr. Cole, the Superintending Surgeon Ceded Districts, makes the following remarks on the subject.

### I.

It is probable that some letter press accompanies Mr. Greenough's Geological Chart of India, descriptive of the system of colouring he has adopted, which might explain what is otherwise unintelligible to me, for what reason he has put down so much of the Southern part of India, as *syenite*. If it is intended to indicate the particular prevalence of hornblende in the rocks, it certainly does not apply to the Bellary District, for there the presence of that mineral is rather the exception than the rule. The rock on which Bellary fort is built (450 feet high and about 2 miles in circumference) consists of granite, of the usual composition (quartz, felspar and mica); Newbold says, it contains hornblende as well, but this I have not observed. The low rocky hills around Bellary are of precisely the same structure, one of them apparently, from its hue (that towards the eastward) containing large crystals of flesh-coloured felspar; this I judge from fragments I observe on the plain. In the Chart, the Bellary rocks are properly coloured as granite, but it is not entered among the "granite clusters and masses;" while Ghooty rock which is granite, is coloured "diamond sandstone" though down in the references as being "granite." But these granitic elevations, compared to the vast plains extending around, are as very small islands in the ocean. These extensive plains are perfectly level, and are formed of the often described *regur*, or black cotton soil, and of a mixture of *regur* and a reddish pebbly soil\* besides about 2½ millions of acres of what is called *lal*, or red soil; which is stony and uncultivable, I apprehend comprising the up-lands or ground at the foot of the hills, yet the whole of this area is marked by the colour denoting "*syenite*." Is it intended that the underlying rock is of that character? I cannot find any authority for such a statement in Captain Newbold's, or other writings, which I have at present access to, and what little I have observed of deep excavations does not warrant it. The same wide plains of *regur* spread out on

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\* Of which in the Bellary Collectorate there are 3 millions acres.

each side of the road from the Pennar to Cuddapah, all which are coloured as "syenite" or "diamond limestone." That the latter rock and the diamond sandstone in the Cuddapah District are arranged so symmetrically as appears in the Chart, the former comprising all the low-lands (for forming the underlying rock) and the hills all being sandstone, cannot be literally correct; though Newbold says, "the formation around Cuddapah is an argillaceous limestone of a dark slate-blue colour, embedding iron pyrites, occurring in strata nearly horizontal. The hills in the neighbourhood are of sandstone, in some parts associated with conglomerates;" yet this will not justify the precise line of demarcation between the rocks laid down in the Chart. I have not traversed the country between Cuddapah and Kurnool, north of

the Pennar,\* as I have the tracts before mentioned, but I believe plains of regur exist there. I would suggest that, in these Districts except where hilly tracts are known to exist, a brownish black hue be substituted for the *red* and *blue*, to indicate extensive level plains of regur and its associated soils. Refer to Newbold's "Account Historical, Geographical and Statistical of the Ceded Districts" in the Madras Journal of Literature and Science, No. 24, and to a paper by the same author under the same title, in Pharoah's Madras Almanac (year unknown,) in which title the Geological details are more particular. Also see "Report on the Proceedings of the Officers engaged on the Magnetic Survey of India," by Herman and Robert Schlagentweit, (Madras 1855) which Mr. Greenough no doubt can get at the India House.

## II.

The range to the eastward of Bellary, colored in the Chart as granite, and having affixed the mark indicating the presence of copper, I think should have been laid down to the westward,\* and if so, is quite of a different character, and is thus described by Newbold; "a range of hills composed chiefly of a chloritic slate, crested with angular masses of a rock composed of a jaspery clay, highly impregnated with iron, and a chert-like quartz in alternate laminæ. The highest of the range is known by the name of Copper Mountain, from its containing that metal. The ore, which is the green carbonate of copper is found in the slate "clay." This range is of considerable extent and great altitude, far exceeding any of the granite clusters, and is the commencement of the series of secondary rocks, which are continuous with these of the range I am about to notice.

## III.

To return to the neighbourhood of Bellary. The "fossil-tress" put down

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\* The Copper Mountain so called bears W. S. W. of Bellary.

as found near that place, I never heard nor read of, nor does Mr. Pelly, the Collector, know of such a deposit.

#### IV.

The Sundoor hills, on one of which (Ramandroog marked on the Chart *Sanatorium*) I am while writing these remarks, are colored "*granite*," in the Chart, but there is not a trace on this hill, nor, I believe, in one of the group, of that rock, nor any of its associates. Ramandroog\* is composed of a singular series of rocks. It is a long narrow hill, about 1 mile in length and  $\frac{1}{2}$  in breadth on the upper plateau, the upper part being composed of clay iron stone, and the slopes, in every direction, consisting of a very great variety of schistose rocks, containing antimony and manganese. The iron stone has all the appearance of being an erupted rock, and of having caused the upheaving and dislocation of the shales, which on every side rise towards it, in highly-inclined strata, sometimes almost vertical.

It is massive and very heavy, apparently containing a large proportion of iron, frequently hæmatitic, but occasionally perforated with cavities, filled with an ochrous red or yellow earth. A specimen selected from the latter portion, might be mistaken for the *laterite* of the Western Coast; in fact, if this rock was at the sea level, in the humid climate of Malabar, saturated with water, a great portion of it would be soft and sectile, as the laterite is, most likely. Of laterite I shall have more to say, in the comments I shall take the liberty of making on the formations as laid down in the Chart of the Neilgherry Hills.

#### V.

The shales of Ramandroog are some soft and aluminous, colored with iron, friable and easily separating into laminæ while very much is highly siliceous flinty slate, much variegated in different colored laminæ, breaking into slabs, but with difficulty; also some chlorite slate, and a sandstone, highly crystalline, but schistous, containing iron pyrites; this latter, I have not seen *in situ*. In these shales nests and small beds of manganese, are found, in the slate of hydrated binoxide, it appears to me; amorphous, principally, and frequently pulverulent, sometimes botryoidal and stalactitic. Antimony is found in small

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\* This hill is only a portion of the western range of the Soondoor territory. The length of this chain is 15 miles commencing near Hospet and running E. S. E., the highest peak is about 3,400 feet above sea level.

The remarks in the text apply to the whole range; the formation, inclination of strata and phenomena of rocks being of a similar nature throughout.

quantities, only, as far as I have been able to discover, and in the form of grey sulphuret, of which some beautiful acicular crystals are found.

## VI.

To the west of this group of hills, is situated Humpay (Bejanuggur) at a distance of 18 miles, on the Toombudra, where is one of the principal granite formations of these parts, but no coloring so indicates, while, as I have pointed out, other ranges are erroneously colored, as "granite." Newbold names the principal clusters of granite, as being at Bejanuggur on the North West Frontier, to the south at Palasamoodrum, to the north at Adoni and to the south at Pennaconda.

## VII.

There is a spot lately examined by me in the Ceded Districts among the secondary rocks, which as presenting an unusual feature in the geology of these parts, might as well be noted on the Chart. It is a rock, from the surface of which exudes petroleum. The rock is a friable, oolitic kind of limestone, associated with compact limestone containing iron pyrites conglomerate, formed of pebbles of the neighbouring formation sandstone, and arenaceous schists. The source whence the petroleum proceeds is not observable. It has a somewhat animal odour. Specimens from this deposit have been (I believe) sent home to the Court of Directors by the discoverer, Major Bisset, of the Civil Engineers' Department, through Dr. Hunter of Madras. It is at a place called Oodamulpaud, in the centre of a triangle formed by Ghooty, Yadakee and Dhonee.

7. The country between Kurnool and Cuddapah north of the Pennar has very much the same geological features as those above described by Dr. Cole, south of that river; the regur near Cuddapah possessing a lighter color, but on approaching Kurnool acquiring the deep black hue characteristic of the soil around Bellary. A vast surface of the country in both the Kurnool and Cuddapah Districts is covered with these rich soils. But on approaching the great chain of the Yerra Mullah hills the aspect changes, and the *lal* covered with low jungle, and studded with granitic fragments, is found along the uplands near the base of the range, which takes its rise about eight miles east of Madaveram in the Jummulmudgoo Talook of Cuddapah on the high road to Madras from Bellary running north west to within 4 miles of Kurnool, a distance of about 70 miles, and varies in breadth from 1 to 12 miles. The Nulla Mulla hills run from Cuddapah in a northerly direction about 130 miles up to the Kistnah with a spur to the westward extending about 60 miles. Both these ranges are of the same geological formation, which is thus described by Lieutenant Newbold; "Their formation is clay slate, sandstone, quartz

rock, silicious and arenaceous schist, with a few hills of blue and grey limestone: the base of these rocks is granite."

QR. MR. GENL. DEPT., C. D.,  
RAMANDROOG,  
1st May 1856.

(Signed) A. R. DALLAS, Major,  
Dy. Asst. Qr. Mr. General,  
Ceded Districts.

Supplementary observations by Dr. Cole, Superintending Surgeon Ceded Districts on the Geological features of the Neilgherry Hills and the neighbouring Coast.

"Laterite."—The Deputy Assistant Quarter Master General of the Ceded Districts, having done me the honor to submit to me the Geological Charts\* of India by Mr. Greenough for me to offer any observations I had upon the geology of these parts, I am desirous to say a few words also on that singular and entirely Indian rock called laterite.

\*forwarded  
by Banghy  
this day.

And first as to its general characteristics. As far as I know there is no extensive deposit of the true rock except where it was first observed by Buchanan, who first described and named it, namely, on the Malabar Coast.

In the numerous other localities whence hand-specimens of the so-called rock may be obtained, it is merely decomposed greenstone or some other hornblende rock in which the iron of that mineral is oxydised, and the felspathic constituent is softened into clay; or as at the Red Hills near Madras, a conglomerate (see a paper by me in No. 12 of the Madras Journal of Literature and Science.) Amidst the trap of the Deccan the lateritious rock at Bedar and other places, the brothers Schlagentweit in their Report formerly named, say it "is the produce of the decomposition *en place* of the trap and amygdaloid." Voysey, an old writer on Indian Geology, in the "Gleanings of Science," a book published at Calcutta many years ago, in an early number of the Journal of Asiatic Society of Bengal, stated his opinion, that in the Deccan it probably was a volcanic mud eruption.

But, in its true locality, the Malabar Coast, is decidedly a rock *per se* and most extensively deposited; not however, so extensively or so symmetrical as is laid down in the Chart, from which it would appear that the whole of the southern extremity of India consists of this rock and granite alone. My belief is, that laterite is not found eastward of the Neilgherries, and of the southern continuation of those mountains. I mention this as my belief only, in order to give rise to further enquiry; and I would suggest that Mr. Greenough's Charts be by no means returned to Europe, without a copy thereof having been submitted to General Cullen, the Resident of Travancore, (if indeed

one has not already been submitted to him) ; as the geological knowledge of that scientific Officer would be of the greatest use in verifying or correcting the formations set down therein, and especially with regard to this very laterite, on a tract of which he now resides. That the structure of the Neilgherries and of the southern extremity of the western ghaut mountains is of so very simple a nature as is laid down in the Chart is certainly, to my knowledge, as far as regards the Neilgherry plateau, incorrect. True granite (mica, quartz and felspar) is found only at the very highest peaks of the range, in very limited quantities ; lower down a binary granitic compound (felspar and quartz) is extensively found ; but the great mass of the mountains consists of greenstone with hornblende slate in low situations in the villages and on the mountain flanks, and gneiss containing hornblende, low down on the mountain sides (See Report on the Medical Topography, &c., of the Neilgherry Hills, published by the Madras Medical Board, the geological portion of which was contributed by me)."

Qr. MR. GENL'S. DEPT.,  
CEDED DISTRICT,  
RAMANDEBOOG,  
6th May, 1856. }

A. R. DALLAS, Major,  
Dy. Asst. Qr. Mr. General,  
Ceded Districts.

#### MEMORANDA.

The geological formation in this vicinity is eminently igneous ; monoliths of great size and stupendous blocks of granite heaped one on the other and fantastically grouped, form numerous amphitheatres.

The granite varies from small close grain through the binary and ternary to large porphyritic, though as a general rule mica is in small quantities and in minute proportions. In many detached granite blocks the aspect is sedimentary, attributable more I conceive to sudden cooling down than to the conditions of gneiss. Felspar in large massive detached crystals is frequently met with and also granular quartz though not of very fine grains ; quartz rock is found compact in detached ridges which will be more specifically referred to below. The soil of the plains is evidently a decomposition of rocks strongly and almost thoroughly impregnated with an infiltration of iron, the deposit being throughout of considerable thickness, and not superficial merely, overlying granite and the Ammoor trap rock. At considerable depths when digging for kunkur, I have found veins of coarse pulverized graphite. To the west and north west of Secunderabad, chalcidony and poor cornelian with amethystine quartz is common, this latter varying in color from the palest to the deepest hues, it is found in veins at small depths from the surface running in every direction north, south, east and west, in compact crystallized masses, the pyramids of

great size closely aggregated and all invariably covered with an infiltration of iron. Detached crystals are rarely met with. The Natives employ the deepest shades in the manufacture of rings and beads. All over this part of the country are what are termed commonly "Scythian Tombs" affording ample food for antiquarian, more than geological research, but in many of the slabs forming the interiors of these tombs, I have found augite, olivine and schorl in connection with the granite. The localities whence these gigantic slabs in some of the principal ones have been quarried are apparent at some distance and recognizable by the presence of these minerals. I have had permission to open several of these and have found the larger slabs all to be of this granite, whilst others of apparently less note are of the coarser grain.

Close to the village of Bonipilly is an irregular ridge running due north and south composed exclusively of compact quartz rock, milky and rose colored, enclosing occasionally garnets but all in a state of decomposition. The same kind of ridge, but on a larger scale, is discernible on the high road westward three miles from the village of Kokutpully, while a similar one of still larger dimensions about 12 miles to the westward assumes the form of basaltic rock. These three elevations run parallel to each other and increase in dimensions and solidity as they lay westward. In this particular locality the basalt rock is not a common feature, though occasionally found in detached hills or rather hillocks more to the westward, but on the western ghaut, of the Peninsula it is in stupendous form. The basalt rock, as specimens, which I have found in the immediate vicinity of Hyderabad, is for the most part very compact and rarely vesicular containing augite in large proportions and well defined crystals, it is however to be found vesicular the cavities filled with concretions of a silicious nature approaching to amygdaloid, but this rock must not be considered as a general inhabitant of the locality under description but a partial one merely. To the westward near the village of Ismaelkhanpet, on the banks of the Manjerah river, as indicated by Dr. Malcolmson, univalve and bivalve shells embedded in chert, are numerous. There was a large collection of the minerals of the Hyderabad country the property of the late Dr. Lancaster Bell, employed in searching for coal in that district (which at his death were sold by public auction and passed into the hands of a Native of the city of Hyderabad. These with his notes would I conceive throw much light on localities the subject of the present enquiry, the opportunities afforded me as a Military amateur being so few that any information I may offer must in comparison be considered superficial merely.

Is one mass of laterite rock. In this locality it differs from  
Becker. that found more westward, inasmuch as it has the appearance of

baked clay with nodules of iron stone imbedded; from the partial presence of scoræ it would seem to have undergone a less active fusion. The table land thus composed terminates to the north and west abruptly and precipitously, whilst to the south and east the descent is gradual. To the N. E. detached hills of trap appear studding the plains till further eastward; and these are bounded by the granite groups around and to the west of Hyderabad. At the foot of the range to the north close to a Mahomedan mosque or tomb is a thermal spring, the temperature of which is highest at early dawn. The bottle containing the water for analysis was, I regret to say, broken in transit. On the table land of this laterite, wells are cut which serve as reservoirs for water; when sufficiently dried by the rays of an almost vertical sun; these wells are impermeable. Beder is famed for its ancient collegiate buildings inside the city and the tombs of its Kings outside, and in modern times for its manufactory of zinc vessels inlaid with silver. A peculiar clay used in the blackening of the zinc is found in the vicinity, the oxydizing properties of which give a gloss and depth of color which increase by friction.

Jaulna. The country is intersected by streams of water all of which contain pebbles of agate, chalcedony, jasper, green stone, and quartz, and following up any of these, large fragments are procurable. This remark is applicable to the environs for many miles. Due north of the cantonment is a table-land of alluvial black soil resting on red gravelly beds; here and there trap-rock formations isolated appear, and the country round to a considerable extent, intersected occasionally by a rapid nullah is precipitous and rugged. To the west of Jaulna, near what is termed the Parsee hill, beautiful agates, calcedony, opal (noble and common) with water-worn crystals of pure quartz are found, whilst to the northward following the course of the Poorna river and its tributaries to their sources, jasper, (blood and ribband), are in immense masses; geodes of quartz of immense size are found interspersed on the surface as well as partially buried on the table land. About eight miles north of Jaulna basaltic formations appear with precipitous and columnar developments. The Godavery river has furnished numerous specimens of fossil bones some of which imbedded therein and in approximate localities, appertain to very large species of mammoth or elephant. I have a specimen in my own collection.

**Erratum.** In the Map I would point out an error in the name of the stream which flows past the city of Hyderabad. "Moosy" for "Bussy."

C. GRÆME, Colonek,

*5th Madras Light Cavalry.*

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No. 811.

TO THE QUARTER MASTER GENERAL OF THE ARMY,  
FORT SAINT GEORGE.

SIR,

No. 125.

Requiring any information which may be procurable upon the Geology of Southern India.

I have the honor to acknowledge receipt of your Circular Letter, dated 30th October 1855, number and subject as per margin.

I cannot lay claim to more than a very superficial knowledge of Geology, but I believe myself to be complying with the intention of your letter in offering observations upon such points connected with the subject as have come under my notice, during the tours which I have made through various parts of the Southern Division.

I may say that I am acquainted with the Districts of Trichinopoly, Tanjore, Madura, part of Salem, and a small portion of Tinnevely and Coimbatore; the western and extreme southern parts of the Division have not been travelled over by me.

The Geology of the abovenamed Districts presents, to an unskilled observer like myself, but few points of interest or variety, the formations being with one small exception at Ootatoor near Trichinopoly, apparently of primitive rocks and minerals of igneous formation and the soil apparently formed by the gradual decomposition of these rocks, whereof the detritus has settled down upon the extensive plains of this part of the Carnatic.

The great mountain ranges of the Coollamullays and Puchaymullay, the Collerymullays and Shervaroy Hills; the Pulneys and Seeromullays; likewise the bare and rounded rocks which stand out in isolated masses from the plain such as those of Trichinopoly, Namcul, and Dindigul, are formed almost entirely of syenite of a reddish color, and in the case of the larger ranges of granite and gneiss, filled with felspar and mica, iron ore, in great variety, some of it strongly magnetic is also universally met with, and in the form of black sand, forms a portion of the bed of almost every nullah. Quartz, of different degrees of transparency, is an ingredient in nearly all the granite rocks, and is likewise scattered, in fragments, over the whole face of the country; a very beautiful crystal, known as the vellum stone, is found at Vellum near Tanjore, and is cut into lenses and ornaments of various kinds, and sold at a low price; I have bought a piece of it in its rough state, containing half a cubic foot, for 4 annas: smaller crystals, and also amethyst, are found on the higher parts of the plain at Trichinopoly, and, a short time ago, a Native was employing many coolies in digging for crystals in the nullahs near the Brigade ground, and, as I understand, with great profit. A Mr. Heath is said to have made a great deal of money about 30 years ago by digging for crystals,

of a bluish green color, at Kangyam, in the Coimbatore District. One of these I have in my possession, but I do not know its English name. The Natives call it simply "Puchaykul;" the excavations have been discontinued for many years, owing to the inferior color of the stones latterly procured and also to the expense of clearing the pit of water as it became deeper. A vein of chrome was discovered near the chalk hills at Salem, and worked for some time, but it is now too deep to be advantageously worked any longer. The varieties of calcareous stone are many, on the banks of the Cauvery, between Bhowany and Nerinjepett; the limestone is spread all over the surface of the plains, in coralline and ragged forms; it likewise is met with in large sheets and masses, filling the interstices of the basaltic rocks, which are there very common, and is also met with as in nearly every part of the country, in the form of nodules or kunker, either in separate beds, or largely mixed with black soil, when such occurs. Talc is to be met with, chiefly in the neighbourhood of the syenitic rocks at the foot of every mountain range. Corundum is found in great quantities, at Shunkerry Droog near Bhowany; and, to a smaller extent, throughout this part of India. Basalt and basaltic hornblende are common in the plains between Trichinopoly and Salem, also between Salem and the left bank of the Cauvery and at the foot of the Hassanoor mountains near Audim on the right bank of that river; they usually appear in the form of long low ridges broken up into clinker-shaped fragments, and what I think is worthy of remark, running almost invariably east and west. Fragments of basalt are also often imbedded in sheets and beds of limestone. This is particularly observable at the left bank of the Cauvery about 30 miles north west of Salem, near the village of Tippumpetty. The only instances of columnar basalt which I have met with are near Bhowany, on banks of the river of that name, where they crop out of the limestone beds, with an angular inclination to the eastward.

The only instance of organic animal remains with which I am acquainted is that of the bed of the well known "Trichinopoly Shell Marble" which occupies a small portion of the plain about five miles to the eastward of the village of Ootatoor on the old road from Madras to Trichinopoly. This marble, which appears to be a kind of limestone (I speak under correction), is of a dark slate color, and is completely filled with petrified shells of several species, but to what period these shells belong, I am unable to say. This marble takes a high polish, and is much used for ornamental purposes, and is probably the only recent rock-formation in this part of India.

The prevailing soil in all these Districts may be said to be the red soil abounding in the ferruginous element, with extensive beds of laterite. On the Trichinopoly and Madras road near Padaloor, the laterite contains small crystalized masses of magnetic iron. With this red soil, black or cotton soil

alternates, especially between Padaloor and Toramangalum, and westerly from thence to the base of the Putchaymullay range. In Tinnevely also, the black soil prevails, occasionally crossed by ridges of red earth, running mostly east and west; patches of tenacious white and yellow clay, likewise occur over most parts of the country, and especially between Madura and Dindigul, the white soil is much impregnated with soda and saltpetre.

As I presume that all this country has been already traversed and commented upon by men well skilled in the Science of Geology in all its branches, I cannot hope that the observations I have made can throw a new light upon any one point. Nevertheless, as this fact is as patent to you as to myself, and as I have been called upon to "contribute anything by way of information," I trust I shall not be considered presumptuous in having noted down at such length such things connected with the general features of the country as have occurred to me on this occasion. Had the information been called for in the shape of questions, or otherwise in a more definite form, I might perhaps have been able to have given a more satisfactory answer. As it is, I hope that my acknowledgment of want of scientific knowledge on the subject will be admitted as an excuse for its deficiencies.

I am not acquainted with any Gentleman in the Division who is likely to be able to give information on its Geological features, except, perhaps, Lieutenant Tyrrell, 2d Assistant Civil Engineer, who, I know is fond of the investigation; but who has not had an opportunity of seeing any great extent of the country.

I have, &c.,

E. F. BURTON, Captain,

*Deputy Assistant Qr. Mr. General*

*Southern Division.*

CAMP BHOWANY, }  
29th November 1855. }

No. 52.

TO THE QUARTER MASTER GENERAL OF THE ARMY.

*Fort Saint George.*

SIR,

I have the honor to acknowledge the receipt of your letter dated 8th December last, number and subject as per margin, and regret to state that I have been disappointed in not obtaining information regarding the geological features of the country embraced in the Northern Division from those who I thought were likely to possess it; but, as far as I am myself capable of judging the portion of the Map, comprising the Vizagapatam and Ganjam Districts, appears to be correct.

No. 2005.

With reference to letter, No. 515 of 27th ultimo, acquaints that one set of Mr. Greenough's Maps will be forwarded to his address and to give an idea of how the Honorable Court of Directors wish the information to be conveyed, forwards an Extract from their Despatch on the subject.

I regret further there should have been so much delay in replying to your letter under acknowledgment, but it has been owing to my absence from Waltair, on duty, to which place I only lately returned.

I beg to add the Maps have been returned to you by this day's banghy.

I have, &c.,

QR. MR. GENL'S. DEPT. N. D. }  
WALTIRE, 7th February 1856. }

C. SHAKESPEAR, Captain,  
Dy. Asst. Qr. Mr. Genl.  
*Northern Division.*

(True Copy.) H. O'CONNELL, Captain,  
Ag. Dy. Asst. Qr. Mr. Genl.  
*of the Army.*

Communicated to the Public Department.

C. A. BROWNE, Lieut. Col.,  
*Secretary to Government.*

*To The Public Department.*

RESIDENT'S OFFICE,  
COCHIN, 4th January 1856.

REMARKS OF LIEUT.-GENERAL W. CULLEN, UPON THE GEOLOGICAL  
MAP OF INDIA, BY G. B. GREENOUGH, ESQ., F.R.S.

No. 1.

FROM LIEUT. GENERAL W. CULLEN,

*Resident of Travancore and Cochin.*

To T. PYCROFT, Esq.,

*Chief Secretary to Government,*

*Fort Saint George.*

SIR,

1. I have the honor to acknowledge the receipt of extract from Minutes of Consultation, No. 1268 of 28th November 1854, and the Geological Map of India, by the late G. B. Greenough, Esquire, F. R. S.

2. It must have been an undertaking of extraordinary labour, and, it appears to be on the whole, wonderfully correct; but of course in a work of such magnitude and the first of the kind that has been attempted, little omissions and errors in its details may naturally be expected, and I make the observation more particularly with reference to the coloring of the Provinces of Travancore and Cochin.

3. Too much prominence has, I think, been given to the *laterite* formation. The great ridge or crest of the chain of ghauts separating the Coast of Malabar from the Collectorates of Tinnevely, Madura and Coimbatore, is, I believe, correctly colored as granitic; but the whole of the spurs also, extending from the great chain in a westerly direction even down to the very edge of the sea at Colachel, Trevandrum, Quilon and as far north as Cochin, are also granitic or gneiss, though erroneously colored exclusively as laterite. Several reefs of rock two or three miles out at sea and parallel to the coast between Trevandrum and Cape Comorin are also granitic. The last 20 miles of the south of Travancore towards Cape Comorin consists also *exclusively* of gneiss and granitic rocks without any laterite.

4. Compact laterite, it is true, is found nearly every where on the general level of the country near the sea coast, and for about 10 or 15 miles inland, and occasionally further; but generally covered with a lateritic gravel or soil always susceptible of cultivation, but with granitic or gneiss rocks constantly protruding or cropping out.

5. Neither is there any notice of the deposits of magnesian limestone with shells underlying the laterite of Quilon, nor of a nearly similar deposit in the backwaters of Cochin. There are also indications of a calcareous and rather friable sandstone along the beach for 10 or 12 miles west of Cape Comorin, while wherever the laterite prevails, viz., from about 20 miles south of Trevandrum up to and north of Quilon. There is also generally found at a distance, varying from one or two to six or eight miles inland, and running parallel to the coast, strata of a highly indurated rather coarse grained, and dark-colored sandstone, with an argillo-siliceous and ferruginous cement. It is called Nurri Kull and forms an excellent building material for large works, such as bridges, though but little used for domestic purposes from its extreme hardness.

Dr. Carter's Journal of  
Bombay Asiatic Society,  
January 1854.

6. I think this coarse ferruginous sandstone is very similar to that found near Puddagam road between Rajahmundry and Samulcottah and noticed by Dr. Benza, Madras Journal, Vol. 5, and is found probably elsewhere similarly associated with the laterite. A great mountain in the ghauts called Cape Comorin in Daniell's Views (Mahendra giri) but 20 miles north of the Cape is designated as 2,000 feet above the sea, while it is upwards of 5,000 feet.

7. It is many years since I have visited Malabar and Canara, but the laterite of those Districts to my recollection exhibits a much more compact and hardened crust at the surface of the ground than it does in Travancore or Cochin, but granitic rocks are there also to be found, I believe, nearly down to the sea coast.

8. I observe also that a stripe of laterite is colored as extending from Cape Comorin along the *eastern* base of the ghauts as far north as and even beyond the Dindigul District. I recollect no laterite on that line, but on the contrary the space in question is almost exclusively occupied by a deposit of compact kunkur or travertine overlaying gneiss, and the whole of the remaining interval of the Tinnevely District to the east as far as the sea, although with numerous rocky ridges and low hills of granitic or syenitic rocks, is chiefly, I believe, occupied by crystalline as well as argillaceous magnesian limestones, and on approaching the coast, by Tertiary fossiliferous deposits of sandstones and limestones and other more recent strata.

9. To the very extended space in the south of India colored as syenite, the designation of granite and gneiss would perhaps be more appropriate.

10. The clay-slate formation too, though so important a feature on the route from Madras via Naggery, Cuddapah, and up as far north as Giddaloor, and thence across the Nundi Kunevai ghaut, and after crossing the great limestone field to Banaganapilly, re-appearing between that place and Piaplee, is altogether omitted to be shewn in the Map.

11. This diamond limestone or sandstone tract has always appeared to me one of peculiar interest not only for the variety and beauty of its minerals, but from the regular and perfect series of rock formations from granite to limestone, by which this singular basin is enclosed, I believe, on every side.

12. The sandstone ranges of that tract are uniformly colored as the *diamond* sandstone, but it may perhaps be doubted whether the outer and inner ranges are not sandstones of different epochs. The sandstones of the Gutpurba and Malpurba are also colored as *diamond*, although I believe Captain Newbold states that the gem is never found there.

13. It would perhaps be attended with some expense, but if a kind of skeleton Map of every Collectorate exhibiting with accuracy the ranges of hills and courses of rivers were furnished to the Civil and Military Authorities in each, correct Geological Maps might probably with ease be completed.

14. In the present Map the names of towns are too few to define with accuracy the limits of the several rocks.

15. I observe that it is directed that these Maps should be returned with observations recorded on the Map itself, but to do this would occupy more of my time at present than I can conveniently spare. The Map only reached me in July last, and I observe that they are not required to be returned for one year.

I have the honor to be,

Sir,

Your most obedient Servant,

W. CULLEN, LIEUT.-GENERAL,

*Resident.*

RESIDENT'S OFFICE,  
TREVANDRUM, 30th July 1857.

No. 45.

FROM LIEUT. GENERAL W. CULLEN,  
*Resident Travancore and Cochin.*

TO E. MALTBY, Esq.

*Acting Chief Secretary to Government, Fort Saint George.*

SIR,

1. I have the honor with reference to my letter No. 11 of the 4th January 1856, to report that I have corrected the Geological colouring of Mr. Greenough's Map of Travancore and Cochin, and a portion of Tinnevely, as far as has been in my power.

The chief corrections have been :—

1st. The colouring as Gneiss all the secondary ranges of hills running parallel to the high line of ghats, and extending in many places down to the sea coast. The difference of the tint of red from that of the granite will be evident. They were by Mr. Greenough all coloured as Laterite.

2. The insertion of the indication of Magnesian Limestone, coloured yellow, containing shells at Quilon and Vurkullay, but at Cochin without shells. At Vurkullay the Magnesian Limestone appears to be associated with the Lignite Deposit of that locality, which latter is coloured black.

3. The insertion of the indication of Sandstone hills, coloured dark green, along the sea coast at, and S. of Trevandrum; they are rather coarse and argillaceous until the approach to Cape Comorin, where they are succeeded by calcareous sandstones, but little raised above the level of the sea.

4. Is the Graphite deposit marked A.

5. A tract of land along the E. base of the Ghats in Tinnevely, which had been coloured as Laterite, but which I have coloured as Travertine.

6. The insertion of three localities in Tinnevely where I discovered Dolomitic Limestone, coloured purple.

7. The insertion of a Dolomitic Limestone, coloured yellow, on the Mountains W. of Thencasea.

8. As already noticed in my report No. 1 of 1856, I observe many little inaccuracies in the Map, but under the press of official business, it would be quite out of my power to undertake any farther corrections.

I have the honor to be,

Sir,

Your most obedient Servant,

W. CULLEN, LIEUT. GENERAL,

*Resident.*

## REPORT OF THE REV. D. MUZZY, ON GEOLOGICAL MAP.

In returning the Geological Map, I will attempt, as requested, to offer some remarks upon the changes made in it, and the authority upon which they were based; and also to give any information respecting the general characteristics of the part of the country which may have come to my knowledge, with the hope that they may tend to increase the general information on this subject.

The changes made are—1st. In the indication of syenite, which is changed to granite in a large portion of the Madura District and in a part of Trichinopoly.

2d. The indication of syenite was changed to that of laterite in a part of the Madura, Poothacotta and Tanjore Districts.

3d. From syenite to fossil-shells in crystalline limestone and in the regur, or dark clay in a portion of the Trichinopoly and South Arcot Districts.

4th. The name Elephant Hills has been changed to Sirumalays of which these hills are spurs, and the name Elephant Rock has been given to that immense block of gneiss situated five miles north east from the city of Madura, to which, from its peculiar resemblance to a reclining elephant, it has long been applied.

5th. The tops of the Pulney mountains have been changed from granite to syenite. This rock in vast blocks and boulders prevails not only upon the top, but to a considerable extent upon the sides of this mountain, and in a few places mingled with a scapolite mineral on the plains.

Quartz rock forming considerable hills, a mountain composed of porphyritic greenstone in the Madura District, and another of crystalline pyroxene, also a bed of grey sandstone in the Trichinopoly District have been designated and named.

Some other changes appeared necessary, but a want of more accurate information prevented their being made. One of these was the cretaceous greensand, which was represented as running through the South Arcot and Trichinopoly Districts; having visited the portion of this formation, or the country designated on the Map as containing it, and not finding any traces of it, nor yet in the many specimens brought from other parts of the tract of country indicated, the alteration to granite has been made of that portion near the Cauvery, and I think that it ought to be made in all the por-

tions of it lying in the Trichinopoly District if not further. The underlying rock in the northern part of Trichinopoly being so nearly allied to syenite, its indication has not been changed. These remarks may, in part, be applied to that region lying between the laterite and the arenaceous tract on the sea shore.

In speaking of the authority upon which these changes are based, as requested, I regret to say, that, I have had access to no treatise on the geology of this region, nor am I aware that any such exists; I am obliged therefore to rely upon observation, but this has been repeated many times and has extended through a period of more than 18 years. Upwards of 600 specimens of the rocks and minerals of the region have been sent to the Madras Central Museum, the names and location of most of which have been published; this list may afford the means of correcting any mistakes which may be made.

I would also mention the assistance rendered by the Collectors of Madura, Trichinopoly and Tanjore, in having specimens of rocks and soils furnished from the different parts of their Districts. I was enabled also to make a tour through these three Districts and Poothacotta in furtherance of this object.

The region of country embraced in these alterations is that included in the four Districts above mentioned. It is bounded on the north by South Arcot and Salem, on the east by Paulk's Straits, on the south by the Gulf of Manar and the Collectorate of Tinnevely and on the west by the Province of Coimbatore and the Malabar country.

Its mountains are the Patchemalies or Green mountains in the north-western part of Trichinopoly; the Pulneys and Serumalies in the Madura District, with various ranges of smaller mountains and detached spurs and cliffs, and some vast rocks. The rivers are the Vellár, or White-river in the extreme north, the Cauvery and Vigay with their branches; these and a few other small streams comprise all the rivers that are found in this region.

The face of the country is that of a level, and in some places an undulating plain; lower in most cases at the foot of the mountains and vast rocks, which rise abruptly from its surface than in other places. As most of the vallies are occupied with tanks and ponds for irrigating the country, ravines and deep water-courses are very few.

The soils are the regur, or black cotton in the north, west and south and in small patches in some other places; the red sandy and red iron in parts of the Talooks of Sevagunga, Maloor, Ramgherry and Tadicomboo.

and the light sandy and gravelly on the sea-shore and in vicinity of the rivers, and a few other places; and the dark-brown vegetable soil confined mostly to the hills and vallies of the mountains. These various soils, with the exception of the last mentioned, contain a portion of clay, but this is so free from it that water penetrates through it nearly as freely as through sand, or ashes, and when burned it falls to pieces like so much earth.

The alluvium beneath the soil partakes much of the nature of the underlaying rock except in the vicinity of the sea and the rivers. There it is either the fine-washed sand mingled with land, fresh water, or marine shells, or the fluviatile and lacustrine deposits. A deposit resembling the loess of the Rhone and the silt and crag of some pools of England are met with in various places.

In noticing more particularly the features of this region we find, that in the northern part of the Trichinopoly District in the black soil through which that remarkable bed of fossil shells and crustacea passes, and in the vicinity of the Vellar are beds of a pure basalt, both in nodular masses and in large blocks, and as it breaks with a smooth and even fracture, it is used, to a considerable extent, for building purposes. Adjoining this in the north east are beds of laterite resting upon syenitic granite. And in the north west the plains are much variegated by the out-croppings of this underlying granite, which in some places passes into syenite and greenstone and rises in other places into hills and mountains that extend westward beyond the boundary of the District, and southward to within a few miles of the Cauvery. Among these hills is a small mountain situated a few miles north west of Moosery composed partly of beautifully pure magnesite and brucite and some of the other magnesian compounds. Where it is associated with iron, it possesses considerable hardness and solidity, but the brucite is soft and friable and has a large proportion of magnesia in it.

Near this mountain, in the direction of Cannanore, is an extensive bed of pure chlorite potstone. This is wrought to a considerable extent, and the vessels made of it, find a ready sale in Trichinopoly, Madura and other large towns.

It is in this region also that portions of the iron ore used by the Porto Novo Iron Company are found. This appears to be an oxide of the metal occurring in small gravelly pieces in the soil and is mingled with much impurity.

In this vicinity three miles from Moosery on the road to Salem, is situated a hill, or small mountain, composed, as far as appearances indicate, almost entirely of crystalline pyroxene associated with beds of albite. Here were masses of beautiful dark green crystals of jeffersonite, black cocolite, forsterite,

and hypersthene. The disintegration of the pyroxene imparted to some places a peculiarly rusty and irony appearance.

At Totiem about eight miles from Moosery the soil though composed of a large portion of sand embeds large quantities of felspathic gravel, which is used for improving the roads.

Near this place is a ridge of rocks composed of a quartzose granite associated with striated siliceous limestone and pure albite, as also massive garnet and chlorite rock, and at a little distance were augite and feldspar.

In the vicinity of the upper annicut on the Coleroon river are rocks of granular limestone, some of which have in their composition silica and pyroxene and some a portion of serpentine and the rock is a variety of verdantique marble.

To return again to the north, we find at Valcondapuram and vicinity considerable quantities of magnesian rocks. In some cases they are associated with lime and a cherty rock resembling a compound of jasper and lime. Beautifully pure specimens of magnesite as also round shot like grains or crystals of ferruginous oxide of Titanium in nodular concretions of recent limestone are found here.

The same kind of granite as mentioned above is found to underlie all this region to within about 10 miles of the Coleroon; in some places it is associated with the common granite as its frequent outcrop and disintegrating fragments in the soil plainly show. Nearly all the mountains and hills however and most of the vast blocks that nearly cover the surface in some places are syenitic. The granite near the river Coleroon is of the common kind and highly porphyritic.

At the junction of these two kinds of granite and crossing the road from Madras to Trichinopoly near the 182d mile stone from the former place is a bed of finely and evenly stratified grey sandstone. The strata are from 2 or 3 inches to  $\frac{1}{16}$ th of an inch in thickness, and they separate with a fracture so smooth and even that the pieces resemble smooth plates of slate. A specimen obtained there is about 2 feet long, one foot wide and 1 inch thick and nearly as even and smooth as a board. The small crystals of feldspar contained in it are of the orthoclase species, and of a dull flesh colour.

The extent of this bed has not been ascertained; it has been traced however more than a mile in length, but the width of the outcrop is not more than 10 or 15 yards; and it runs in a direction nearly east and west. The strata on the south side of the bed are crossed by joints which pass through it nearly parallel to each other and about two feet apart and at an angle of about  $50^{\circ}$

with the line of direction ; the dip of the strata appeared to be about  $60^{\circ}$  on the south side and nearly  $20^{\circ}$  in the centre, while that of the north side was not satisfactorily determined. A singular characteristic of this bed is, that the strata on the south side of it are composed of nearly pure silicious sandstone ; in the middle they were porphyritic, containing felspar, while those on the north side were composed almost entirely of a greenish black hornblende, these thin strata forming a beautiful hornblende slate. This appeared to be the junction of the two minerals hornblende and mica ; to the north of this, hornblende, either in a free state, or combined in syenitic granite, or greenstone, is prevalent, while to the south of it mica, combined with quartz and felspar forming the common or porphyritic granite, is equally prevalent.

We have now arrived in our notices of the country at the eastern part of the Trichinopoly District, which is traversed by that remarkable bed of fossil-shells already referred to, sometimes called the Ootatoor marble. In the tour mentioned above, this region was visited, and I proceed now to state a few particulars in regard to it.

In the vicinity of Ootatoor the syenitic granite containing garnets is very abundant, it crops out and lies on the surface in flat masses and huge blocks ; and rises into hills and mountains imbedding in some places the blue or oolitic quartz, fine specimens of jade, crocidolite, and a black curiously crystalline carbonate of lime and small pieces of iron.

About half a mile east of the Travellers' bungalow, the granite disappears from the surface, or remains only in small quantities and scattered in disintegrating fragments. The prospect from this place to that north, east and south is that of a great plain extending in vast wave-like undulations as far as the eye can reach.

The soil is a dark loam containing magnesia and lime evidently formed from the disintegration of the rock on or beneath its surface. Small pieces of red irony crystalline limestone as also pieces of the marble full of small white shells of the multilocular class called the turrilite are found here.

In the rolling surface of this plain there is a fair opportunity, considering the loose and earthy nature of the soil, for the denuding effects of the water, hence we see many of those ridges worn into banks and mound-like and deep ravines by the torrents. One of these, about a mile east of the bungalow is well marked. The ravine is about 58 feet deep and lays bare the surrounding strata to a considerable extent. The upper stratum on the western side is a marl or earthy limestone and occupies a large portion of the surface ; the next stratum below appeared to be an iron sandstone slightly resembling laterite yet regularly stratified, and of a reddish brown color, evident-

ly containing a considerable quantity of the oxide of iron. Farther to the north where other smaller ravines come into the large one a still lower stratum is laid bare, it consists of a well-defined gneisoid sandstone. It is plainly and evenly stratified with layers of mica, silicious sand and felspar, or lime. This stone is soft and friable and appears to be considerably extensive, underlying much of the western part of this plain, its thickness is unknown. In a bank in the lower part of the ravine were strata of a pure white clay, or chalk alternating with layers of a dark dun-colored substance of the same apparent composition; both containing carbonic acid and effervescing freely with acids. This dun-colored clay is very extensive throughout this region and becomes indurated and passes into limestone. Much of the recent limestone in which the shells are imbedded is evidently formed from this clay; as it exists in different parts of this plain underlying the cotton soil in almost every degree of hardness from that of marl and soft clay to that of compact and solid limestone.

On the east side of this ravine, this clay and the cotton soil which commences here is overlaid with an earth containing salts of different kinds; those containing nitrate and muriate of soda are conspicuous. The sulphate of lime in the form of bladed, amorphous, and fibrous gypsum was so prevalent as nearly to cover the ground in some places although some bandy loads had been collected and sent to Madras. In and on the banks of this ravine were found a large number of the shells called belemnites and specimens of globular, cylindrical and oval-shaped substances, of various sizes from that of an ounce bullet to that of some six or 8 inches in diameter and length. These substances were composed invariably of a dark blood-red or brown-jointed oxide of iron and laterite or fine radiating zeolite. Sometimes these round substances were inclosed as nuclei in nodules of pure white chalk; but more frequently they were covered with a thin smooth cretaceous substance which gave them a uniform appearance as far as the texture of this external coat was concerned.

In our farther examination of this interesting locality it was found, that this black soil and these globular specimens of fossil crustacea, (as there is evidence to believe they are), extended to nearly a mile east of the village of Giridimungalum, which is situated at the quarry of the Oottatoor shell marble, a distance of some five miles north easterly from Oottatoor.

As we passed from this place to Giridimungalum we saw, to the north of our path and some two or three miles from it, what had the appearance of vast banks and mounds of earth recently thrown up. On visiting them, however, we found them high ridges of land washed into the forms mentioned by torrents of water similar to the location just referred to. Here were found nearly all the

different kinds of fossils and minerals that had been found there besides others, such as ammonites of some 8 or 10 different species, some of which though not entire, were more than nine inches in diameter and some entire were about six and seven inches, while, others were only three or four inches, and the nautili were well preserved and had the syphunet well developed. While the fossil crustacea before referred to were here larger and more in the shape of the living animal, some resemble the body of a large lobster, or crab so exactly, that there seems but little risk in calling them fossils of that animal; and some resembled the different kinds of echinus, especially the spatangus. There were also other masses with two lobes somewhat resembling a small saddle having distinct marks of a shell or skin. These are only a few of the great variety of forms and shapes that were met with. These were all composed of the oxide of iron, selenite, or zeolite and lime, as before described. Many of these bodies were broken and the oxide of iron, which had formed them with portions of the fossil animal distinct, lay in different places where they had been entombed. They were of various sizes, from that of the shrimp to that of an animal of some 25 or 30 feet in length.

We next examined the limestone in the village of Giridimungalum; this appeared to be of different ages; while some of it, being highly crystalline, must have been of a high antiquity, other parts of it were more recent, imbedding a different kind of shell; and some appeared to be of the clay above mentioned, and to be, even now, in a state of formation. The shells in the oldest rock, were in the best state of preservation, being much fresher and freer from fracture, than those in the more recent formation, some of them still retaining in part their color and all the small ridges natural to them. This rock is of a bluish color highly crystalline and so hard as to receive a good polish. A noticeable feature of these shells was, that although they were so numerous as to compose a large proportion of the rock, they were, with few exceptions, of the bivalve class.

Not possessing the means, nor the time to name these shells, I do not attempt it. Most of them will be found figured in Sowerby's Geological Conchology, in Lyell's Manual of Elementary Geology, and a few of them in the Madras Journal of Science for June 1840.

We obtained parts of what appeared to be two fossil tortoises and a few large bivalve shells entirely converted into limestone, a number of pieces of fossil wood in limestone; some with the holes made by the teredo nearly filled with calc spar; these also contain knots or the beginning of branches. There was also found at this place, an ammonite in a good state of preservation measuring some 15 inches in diameter and about four inches in thickness; the outward whorl of which is partly free from the limestone which envelopes the central part and shows the shell but little altered. This bed of limestone was

found to be narrow, not being more than half a mile wide in the widest place; we traced its length for about two miles south of the village and could see its outcrop for about a mile further. Persons were sent to follow this bed to its southern extremity, who returned with fossils and minerals; plainly indicating that although its continuous outcrop is not more than about four miles in length it does extend beneath the surface to the village of Pullumpardee near the Coleroon, where it again crops out and is wrought.

From the south of a small rivulet, which runs across it, the rock and fossils appeared to be more silicious, and frequent masses of granite and small pieces of sandstone were found among them. Now considering its extent from Pullumpardee, and that from the rise of ground near Giridimungalum those high denuded ridges, like those where the fossils are so numerous, can be seen extending in a north-easterly direction as far as the eye can reach, and also that this kind of limestone appears on and in the surface in the same direction at Vir-dachellum, Seedraput, and other places between these places may we not safely conclude that this same formation accompanied by its fossils and minerals continues, either beneath, or upon the surface the whole distance from Seedraput to Pullumpardee? If so, we have a space of more than 100 miles in length and from two to five miles in breadth, which, when this country was submerged beneath the ocean, as was most probably the case in, what is called the cretaceous or latter part of the secondary epoch, was the peculiar home and feeding ground of innumerable animals, similar to what the Newfoundland and Bahama banks are now. Here, they lived and flourished and here they died and were buried, and here in the abundance of their fossil remains we read the history of creative wisdom and preserving goodness of which we have such abundant evidence in our day.

In our return to Trichinopoly we found the country near Oottatoor covered, in places with the same dark granite before mentioned, and across the road passed a vein of pure augite slate, so hard and fine grained as to admit of a high polish. At the distance of about three miles south west from Oottatoor occurred the same undulating denuded surface as at Giridimungalum in which were found nodular concretions of iron ochre imbedding selenite which was very pure; here was also found chlorite porphyry and an abundance of crystalline gypsum and a kind of limestone which had the appearance of being simply a mass of fossil hamites, and another kind made up of different species of the shell called *terabratula*, the *turbindia*, and many others; the whole differing entirely from any thing discovered in the other places mentioned. This is an interesting locality and deserves further investigation.

As the formation on the sea shore and in the vicinity of the rivers is composed of light sand, and up from the shore, of diluvium brought down by the waters, it will require no further remark.

We have now come to the northern part of the Madura District. We find that granite underlies nearly the whole of this District; there is reason to believe that the laterite rests upon granite, as it does in other places. So also some of the syenite on the tops of the mountains is found to rest upon granite. Indeed syenite is not known to be an underlying rock to any extent in any part of this district, but appears in blocks or rounded masses both on the mountains and some parts of the plains.

In the direction of Vallum and Poothacotta from Trichinopoly the granite pierces the laterite, which covers most of the surface, in a number of places where it appears either in ridges of some height or in broken masses scattered over the plains, but the laterite does not appear here often in the form of a rock, but of gravel mingled with the soil, or immediately beneath it. In the vicinity of Vellum and from that place south through the Poothacotta and Sivagunga districts, the laterite takes more the form of a glomerate rock and is used for building purposes. Its appearance in some places when it is forming is that of a liquid percolating the soil and forming for itself small pipes, or veins which branch in different directions not unlike the veins in the human system; these multiply and harden till the whole mass becomes thoroughly impregnated with iron, and by degrees formed into a hard and rich iron ore. Considerable hills are formed of this substance in the Poothacotta district; still containing the pipe, or vein-like formation.

From Trichinopoly in a south and south-westerly direction the granite is porphyritic and contains at Verallimalli a vein of nodular greenstone imbedding granular chlorite and beautifully white albite. On the road from Trichinopoly to Dindigul at Amaparthi is a bed of granular limestone imbedding grains of pyroxene, of considerable extent and hardness; this is found in some cases united to the granite, connected with the felspar of which, are crystals of vermiculorite. At Manaparie 25 miles south-west from Trichinopoly, the granite is diversified by large masses of viscid quartz and quartz rock and granite; the minerals found at this place are rock crystals, axinite calcespar, chlorite, ripidolite, octahedral and specular iron, prehnite, chlorite porphyry, polyolite, schorl, albite, pyrope garnet, aquamarine, nigrin, rutile, zenxite, arseniate of copper, nicoline, and crystalline hornblende.

Near Corttamperthe is an extensive bed of silicate of iron; it forms a part of four small mountains and continues in one direction, either upon, or beneath the surface, a distance of about eight miles and contains the different varieties of this ore and their different crystals.

In the vicinity of Tovarankurchy are considerable hills of quartz rock having a quantity of green diallage in its composition. In the *Maloane*

mountains, *gonulite* is the prevalent rock and it imbeds black and common garnets which with the massive variety is found in considerable quantities in the granite soil of this region. Alagiri Malei is a mountain situated 12 miles north of Madura and is about 1,000 feet in height and some 10 or 15 miles in length, and is composed almost entirely of aventurine quartz or micaceous sandstone. Some portions of it appear to have been formed upon a shore and are stratified and have inequalities resembling ripplemarks.

Five miles north east from Madura is that remarkable rock called Elephant mountain, from its resemblance to that animal in a reclining posture. It is a block of gneiss two miles in length,  $\frac{1}{4}$  of a mile wide and some 250 feet high. Strata of felspar, mica, and quartz run horizontally through this mass from one end to the other and are seen on both sides of it, and are crossed at different angles by veins or faults of a felspathic rock which pass through the entire vein. A porch and a temple have been hewn out of one side of it. As there can be but little doubt of the sedimentary origin of this rock, we must suppose it to have been formed in some vast pit and elevated to its present position by that force which has produced so many of the changes which have from time to time variegated the surface of the earth.

The vast fields of granite at the south-eastern base of the Sirumalei and Alagiri mountains would seem to indicate the direction and denuding force of ancient oceanic currents.

At Vadapadi 16 miles north west from Madura is a small mountain composed almost entirely of porphyritic greenstone. The hornblende in its composition is of the dark basaltic variety and the felspar is of the andesine or the white variety and in the composition of the mass the columns appear in spots like the skin of a Leopard.

The limestones of the district are numerous and of various kinds. The lime gravel, or kunker is widely diffused in the soil, and in some places is nearly a pure carbonate of lime; in other places it is mingled with other substances and takes the form and consistence of concreted limestone or pissolite. These are the kinds used for making roads and burning into lime. Travertine or tufa is found in stalagmitic concretions in caves and bordering around the stems and branches of plants. The crystalline limestones are also numerous, they are found in nodular masses and large blocks and show the crystals of calcspar and the fine granular and compact varieties. Some of these kinds receive a tolerably good polish and might, it is thought, be wrought for marble. The minerals found embedded in these stones are the chondrodite, graphite, pyroxene, and molybdenum; and the different locations where they are found are Poovandy, Puntelacodee, Carnapadi, Vitherapadi, in the Tirumungalum Talook and in

a number of other places. In the location at Puntelacoodée the outcrop is some 20 yards in width, six or five miles long and of a depth not explored. These masses of rocks are nodular in most places, nor does there appear to be any regularity of dip in the case of any of them. They lie in wild confusion in every part of these limits resembling the ruin of a vast wall. The stone of the south side of this bed is highly crystalline calcspar of a dull whitish colour, while that on the north side is finely granular or compact, and of a bright flesh colour.

Another feature of the district is its iron. This is widely diffused: it is found in almost every part of the district, either in the form of native iron or united with oxide in the form of *hematite*, of ochre or of octahedral crystals of specular iron and iron sand, &c.; there is the silicate of iron, the carbonate and sulphuret and a vast quantity of laterite, but so small quantities are found in any one place, except of the silicate and laterite that it has been but little wrought.

The region where gold is sometimes found was visited and the sand and rocks of the same, to some extent, examined. The name of the place is Pulkanúth, 14 miles north of Dindigul just under the east end of the Pulney mountains. The gold is found in small particles in the alluvium and sand of a plain at the foot of a small mountain about two miles from the Travellers' bungalow. The soil and alluvium of this plain are composed of the disintegrated and decomposed rocks of the mountain, as the frequent fragments, and sand and gravel abundantly testify. So that there is no doubt, but that the gold was originally in this rock which is in some places a granulitic, in some a micaceous, and in others a syenitic granite containing almandine garnets and specular iron in abundance. The yield of gold as yet obtained is rather small, not averaging more in value than could be earned by day labor. This is probably owing, partly to the inefficient way the labor is performed, and partly to a want of water: it is the opinion of those who have taken gold here that the proportion of gold is much larger at the depth of some feet below the soil than on the surface. Could a shaft be sunk some 25 or 30 feet, there is a fair prospect that the yield would well repay the labor, especially as it would afford water to wash the earth and sand which is now found only at a considerable distance from the place where it could be used.

In concluding these remarks, I would express my sincere regret that they have been so long delayed and that they also bear the marks of so much haste and deficiency; yet as ill health has occasioned my absence from home and prevented the necessary efforts while there, I do not see how it could well be avoided.

I have the honor to remain, &c.,

1st May, 1856.

(Signed) C. F. MUZZY.

To

J. D. BOURDILLON, Esq.,

*Secretary to the Government  
of Fort St. George.*

SIR,

I should have replied earlier to your letter calling upon me to return the Geological Maps forwarded me some time since in order that I might add such information regarding the Geology of the immediate neighbourhood of Rajahmundry as my opportunities might enable me to offer ; but that I delayed this report in anticipation of the receipt from England of a series of rocks fossils &c., which would enable me to do greater justice to the subject under consideration.

I have now the pleasure to return the Maps which I have not thought it advisable to disfigure by making any additions except those marginally given, and which afford but little information beyond that already conveyed in them ; but as I on a previous occasion attempted to impress upon you that my knowledge of Geology was very limited while my opportunities of exploring even the immediate neighbourhood of my station (owing to the nature of my more immediate duties) have been but very few, I need scarcely offer any apology for this very meagre report.

The subjects requiring comment are—1st. The Geological period to which the association of rocks found in this neighbourhood may be referred ; and 2ndly the characters of the prevailing minerals. The immediate neighbourhood of Rajahmundry consist of (1) tracts of rich *alluvial deposit* brought down by the periodical freshes of the Godavery, limited in extent in the neighbourhood of the town ; but a few miles to the southward spreading out into that extensive area known as the delta of the Godavery ; (2) *Diluvium* in the form of gravel, rolled pebbles, and angular masses of the older rocks (derived from the range of hills to the northward) and which spreads over the more elevated tracts of land to the eastward of the town ; and (3) an assemblage of silicious sandstones and sandstone conglomerates argillaceous and calcareous rocks.

The relative order of superposition of these rocks I have not been able to ascertain. The only sections exposing the strata that I have had opportunities of examining are those naturally exposed on the river's bank, and a deep excavation at the new civil hospital. This was carried to the depth of about 76 feet and the section is given in the margin.

But this does not represent all the rocks of the neighbourhood. The

Section of strata dug through on excavating the well at the new civil hospital from above downwards.

|                                                                     | ft. | in. |
|---------------------------------------------------------------------|-----|-----|
| 1. Dark mould passing into two.....                                 | 5   | 0   |
| 2. Red gravelly soil.....                                           | 14  | 4   |
| 3. Variegated marl.....                                             | 0   | 6   |
| 4. Coarse loosely aggregated sandstone with bands of pebbles.....   | 11  | 0   |
| 5. Coarse sandstone with do. (conglomerate?)..                      | 2   | 9   |
| 6. Hard, compact, ferruginous sandstone with silicious matrix. .... | 0   | 6   |
| 7. Variegated clay (fire clay)                                      | 7   | 6   |
| 8. Variegated soft sand stone.....                                  | 3   | 11  |
| 9. Hard compact ferruginous sandstone.....                          | 0   | 10  |
| Coarse sand.....                                                    | 30  | 0   |
| Water being reached.....                                            |     |     |

silicious sandstones of the Dowleswaram quarries and the silicious conglomerates of the high ground to the eastward of the town are not met with, probably they occupy a lower position. It must also be remarked that in the section alluded to not a single organic remains, not the fragment of a shell was discovered; and the same may be said of the sandstone quarries at Dowleswaram. Indeed the absence of all organic remains in the group of arenaceous and argillaceous beds of the neighbourhood, is remarkable.

The acknowledged difficulty if not impossibility, of determining the age of any assemblage of rock by their lithologic characters alone, has necessarily invested the only calcareous bed in the neighbourhood with much interest.

This bed of limestone is quarried about two miles to the northward of the town, and the upper layer of it is rich in fossil shells. The stone itself has many of the characters pertaining to the oolitic limestones; but the fossils would refer it to the lower tertiary formation.

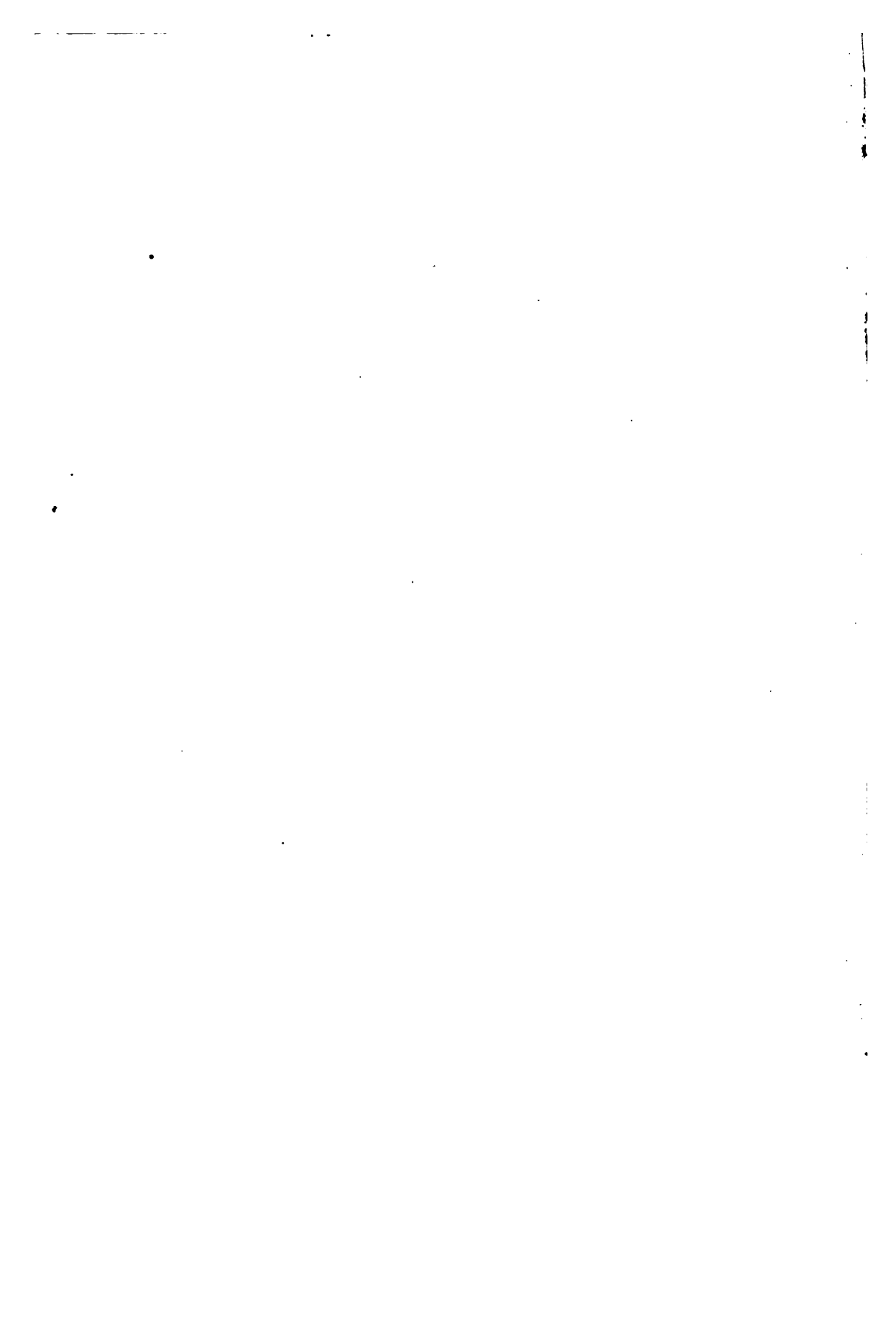
I am so little conversant with Paleontology that I will not venture to name the shells. In as far as I am able to judge, they belong to those characterising the pleocene, miocene and probably eocene periods and comprise both marine (and fresh water?) shells. I shall be happy to forward a series of these fossils should it be wished to determine this point; but I have no doubt but that the rocks of this neighbourhood are, as in the Map, referrible to the tertiary era. The minerals named in the margin of the Map have mostly been derived from the hills to the northward and sent me by gentlemen employed in the last expedition up the Godavery, and are derived from the rocks of the hypogene group and from the metamorphic class.

I have the honor to be,

Sir,

RAJAHMUNDREY : }  
24th June 1856. }

Your most obedient Servant,  
J. L. RANKING,  
Zillah Surgeon.



To J. D. BOURDILLON, Esq.,  
*Secretary to Government.*

SIR,

With reference to your letter No. 1003, 29th August, I do myself the honor to inform you that I yesterday despatched by banghy dawk, to your address, the Geological Maps therein referred to. In a geographical point of view I beg to remark that the Map of this Division is very far from being correct, in fact, I have had some difficulty in recognizing places. In a geological point of view it may, as far as I can learn, be correct in parts as to the different formations, but it is undoubtedly incorrect in other places—for instance, the Goondwana (Putchmurree) range, within the limits of which many coal localities have been discovered, is, in the Map, colored as an igneous rock. The general formation of the hills in this part of the Saugor Division is a continuation of the Bundelcund table-land sandstone, covered in places by trap. I do myself the honor to forward a colored trace, shewing the corrections in the valley of Nerbudda to be made in the Geological Map. The colors represent—Yellow, coalsandstone; Brown, Bundelcund table-land sandstone; Green, Trap; Red, Granite; Pink, Schistes of the Nerbudda Valley. Iron is found in abundance in this Division, and I believe the metal at Teendoo Keira (between Saugor and Chawulputta on the Nerbudda), and Heerapoor (on the road to Cawnpore) is considered the best—coal also is found in several places. I enclose a sketch of a portion of the Putchmurree jungles, shewing spots in which coal has been found. I also add a rough sketch I made of a country but little known, situated to the East of Ummerkuntuk. After descending the Mykul range, the country resembles a rolling prairie, or rather a confused mass of undulations, knolls, or hummocks, rising occasionally into heavy ranges of hills; indeed, except in the long narrow vallies—seldom more than a rifle shot across, there is very little level ground to be found. Over the whole of this wild country is spread a noble timber forest of Surrye wood (perhaps the Saul of Bengal), and in the well watered vallies the grass is green all the year round. The general character of the hills is, to the best of my knowledge, the Bundelcund table-land brown sandstone. Coal is very plentiful, and there is abundance of iron, especially in the Mykul range.

I have the honor to be,

Sir,

Your most obedient Servant.

W. G. P. JENKINS, MAJOR,

*Dy. A. Qr. Master General Saugor Division.*

SAUGOR, }  
25th October 1855.

I beg to add a list of a few works to which reference may be made.

For the general boundary of the coal sandstone South of Nerbudda and coal localities—Lieut. Col. Ousley, *Asiatic Journal*, No. 161 of 1845, and Lieut. J. Finnis in *Asiatic Journal*, February 1834.

For the sandstone along the North of the valley, and the trap in the same direction—Dr. Spilsbury, *Asiatic Journal*, August 1834.

Also the Geological survey map of the Casee Hills, in the Sylhet Division, published by the Bengal Government and by the Geological survey of which Professor Oldnam is the Head in India.

W. J.

No. 347.

MADRAS COLLEGE HALL, 1st November 1856.

FROM ALEX. HUNTER, Esq., M. D.,

*In charge Madras School of Industrial Arts.*

To T. PYCROFT, Esq.,

*Chief Secretary to Government.*

SIR,—In reply to your letter No. 1307, dated 30th October 1856, I have the honor to return Mr. Greenough's Geological Map of India, with such information as I can furnish regarding the Geological formations and Minerals of the Madras Presidency marked upon it.

2. I beg also to forward for the information of Government abstracts of my last 10 years' correspondence on the Mineral Resources of the Presidency, with the names of the parties who forwarded the Minerals to me, and the Localities from which they were procured.

3. Some remarks on the subject will be forwarded to Government in the course of a few days when it is hoped that some accurate information may have been obtained regarding the localities where some large blocks of blue and brown mountain limestone full of fossils of the carboniferous strata have been quarried. The limestones appear to be abundant near Madras as many mills and grindstones now in use contain the same fossils. The quarries are said to be at Tertunny, Muddoor and Attipauchary in the Naggery range of hills. Steps have been taken to identify the locality of the limestone which is not improbably accompanied by coal. The remarks will be forwarded next week, the result of the enquiries will be communicated to Government hereafter.

I have the honor to be,

Sir,

Your most obedient servant,

ALEX. HUNTER, M.D.,

*In charge Madras School of Industrial Arts.*


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NOTE.—The further Report promised has not been furnished, Dr. Hunter stating his inability to procure additional information.

# ABSTRACT OF A TEN YEARS' CORRESPONDENCE ON THE RESOURCES OF INDIA.

LIST OF MINERALS COLLECTED; MOST OF THESE HAVE BEEN FOR-  
WARDED TO THE MADRAS MUSEUM.

A collection was also deposited in the Polytechnic Institution, and other collections have been forwarded to the London and Paris Exhibitions and to private individuals in London, Edinburgh and Liverpool.

| <i>Minerals.</i>                                                                                                  | <i>Locality.</i>                   | <i>Forwarded by</i>       |
|-------------------------------------------------------------------------------------------------------------------|------------------------------------|---------------------------|
| Granite ... ..                                                                                                    | October 1846.<br>Little Mount. ... | Major Worster.            |
| Decaying do. ... ..                                                                                               |                                    |                           |
| Greyish Kaolin ... ..                                                                                             |                                    |                           |
| Fireclay ... ..                                                                                                   | Streepermatoor. ...                | Captain Best (the late).  |
| White Granite ... ..                                                                                              | Arcot.                             |                           |
| Decayed do. the Kaolin of<br>the Chinese, Graun of the<br>Germans, the Cornishstone<br>of the English Potters.... | Ditto.                             |                           |
| White Felspar ... ..                                                                                              | Arcot.                             |                           |
| The Petuntse of the Chinese.                                                                                      |                                    |                           |
| Petrified Woods .. ..                                                                                             | Arcot.                             | .....Lieutenant Holmes.   |
| Fibrous Limestone...                                                                                              |                                    |                           |
| Lepidolite ... ..                                                                                                 |                                    |                           |
| Granite, White Quartz and<br>Felspar ... ..                                                                       |                                    |                           |
| Decaying do. or Kaolin ...                                                                                        |                                    |                           |
| Iron Ore ... ..                                                                                                   |                                    |                           |
| Kaolin ... ..                                                                                                     | Arcot.                             | .....Captain E. A. Foord. |
| White Felspar ... ..                                                                                              |                                    |                           |
| Milky Quartz and Hyalite..                                                                                        |                                    |                           |
| Chert ... ..                                                                                                      |                                    |                           |
| Milk Quartz ... ..                                                                                                | Arnee.                             | .....Captain Brooke.      |
| Rock Crystal ... ..                                                                                               |                                    |                           |
| Blue Quartz ... ..                                                                                                |                                    |                           |
| Potstone ... ..                                                                                                   |                                    |                           |
| Pegmatite ... ..                                                                                                  |                                    |                           |
| Felspar (white, pink and<br>grey,) ... ..                                                                         |                                    |                           |
| Granite with Garnets ...                                                                                          |                                    |                           |
| Do. with much iron ...                                                                                            |                                    |                           |
| Mica and Micaceous Slate...                                                                                       |                                    |                           |
| Sandstone ... ..                                                                                                  |                                    |                           |

| <i>Minerals.</i>                          | <i>Locality.</i> | <i>Forwarded by</i>                                 |
|-------------------------------------------|------------------|-----------------------------------------------------|
| Chromate of Iron ...                      | Bangalore.       | .....C. Smith, Esq., M.D.                           |
| Magnesite ...                             |                  |                                                     |
| Adularia ...                              |                  |                                                     |
| Kaolin ...                                |                  |                                                     |
| White and Pink Felspar ...                |                  |                                                     |
| Lithomarge ...                            |                  |                                                     |
| Corundum ...                              | Bangalore.       | .....J. Kirkpatrick, Esq., M. D.                    |
| Emery ...                                 |                  |                                                     |
| Schorl ...                                |                  |                                                     |
| Glassy Felspar ...                        |                  |                                                     |
| Fibrous Gypsum ...                        | Bangalore.       | .....Rev. J. Garrett.                               |
| Sandstone in formation ...                | Bangalore.       | Minerals found during excursions in September 1854. |
| Iron with Manganese ...                   |                  |                                                     |
| Quartz and Felspar covered with do. ...   |                  |                                                     |
| Red and Brown Hematite.                   |                  |                                                     |
| Laterite ...                              |                  |                                                     |
| Green Earth ...                           |                  |                                                     |
| Yellow Earth ...                          |                  |                                                     |
| Decaying Felspar ...                      |                  |                                                     |
| Colored Kaolins, Red, Pink, Brown ...     |                  |                                                     |
| Lemon Yellow, Grey, Yellow and Purple ... |                  |                                                     |
| Chlorite Schist ...                       |                  |                                                     |
| Mica Schist ...                           |                  |                                                     |
| Decomposing Granites ...                  |                  |                                                     |
| Pegmatite ...                             |                  |                                                     |
| Adularia ...                              |                  |                                                     |
| Moonstone ...                             |                  |                                                     |
| Indianite ...                             |                  |                                                     |
| Compact Granite ...                       |                  |                                                     |
| Sienite ...                               |                  |                                                     |
| Red, Blue, Yellow and Smoky Quartz ...    |                  |                                                     |
| Rock Crystal ...                          |                  |                                                     |
| Natural Concrete ...                      |                  |                                                     |
| Quartz with square depressions ...        |                  |                                                     |
| Dentoxide of Manganese ...                |                  |                                                     |
| Glassy Felspar ...                        |                  |                                                     |
| Dendritic Manganese ...                   |                  |                                                     |
| Topaz ...                                 |                  |                                                     |
| White and yellow Cornelian.               |                  |                                                     |
| White, grey and red Quartz.               |                  |                                                     |
| Rock Crystal ...                          |                  |                                                     |
| Bloodstone...                             |                  |                                                     |
| Striped Jasper Agate ...                  |                  |                                                     |
| Onyx ...                                  |                  |                                                     |
| Fortification Agate ...                   |                  |                                                     |

| <i>Minerals.</i>                             | <i>Locality.</i>                                                     | <i>Forwarded by</i>                                        |
|----------------------------------------------|----------------------------------------------------------------------|------------------------------------------------------------|
| Moss Agate ... ..                            | Bellary. .... {<br>Banks of the Kist- {<br>nah and Tam- {<br>boodra. | T. L. Strange, Esq.<br>Collected by Corporal<br>Blackwood. |
| Sardins ... ..                               |                                                                      |                                                            |
| Grey and brown Calcedony.                    |                                                                      |                                                            |
| Grey and brown Flint ...                     |                                                                      |                                                            |
| Red, yellow and green Jasper ... ..          |                                                                      |                                                            |
| Porphyry ... ..                              |                                                                      |                                                            |
| Common Opal ... ..                           |                                                                      |                                                            |
| Radiated Zeolite ... ..                      |                                                                      |                                                            |
| Wood Opal ... ..                             |                                                                      |                                                            |
| Moonstone or precious Felspar ... ..         |                                                                      |                                                            |
| Common Felspar ... ..                        | Bellary. .... {<br>Copper Mountain. {                                | Dr. Scott, Garrison Surgeon.                               |
| Aluminous Shale ... ..                       |                                                                      |                                                            |
| Grey, purple and smoky Amethyst ... ..       |                                                                      |                                                            |
| Green Granite containing Copper ... ..       |                                                                      |                                                            |
| Porcelain Clay ... ..                        |                                                                      |                                                            |
| Copper Ore... ..                             |                                                                      |                                                            |
| Iron Ore ... ..                              |                                                                      |                                                            |
| Jasper ... ..                                |                                                                      |                                                            |
| Conglomerate ... ..                          |                                                                      |                                                            |
| Petrified wood ... ..                        |                                                                      |                                                            |
| Botryoidal and Stalactitic Manganese ... ..  | Soondoor Hills ...                                                   | Major Henderson.                                           |
| Iron Ore and Magnetic Iron Glance ... ..     |                                                                      |                                                            |
| Tripoli ... ..                               |                                                                      |                                                            |
| Fine Sandstone ... ..                        |                                                                      |                                                            |
| Armenian Bole ... ..                         |                                                                      |                                                            |
| Polier Slate ... ..                          | Ditto. ....                                                          | Capt. Walker, Engineers.                                   |
| Lithomarge ... ..                            |                                                                      |                                                            |
| Felspar ... ..                               |                                                                      |                                                            |
| Decaying do. ... ..                          |                                                                      |                                                            |
| Iron Ore in Slate ... ..                     | Bellary and Road }<br>to Gooty ... }                                 | Mr. Avery.                                                 |
| Do. with Manganese ...                       |                                                                      |                                                            |
| Sesquioxide and Peroxide of Manganese ... .. |                                                                      |                                                            |
| Sandstone with veins of Iron.                |                                                                      |                                                            |
| Amethystine Quartz ...                       |                                                                      |                                                            |
| Whetstones and Polishing Slates ... ..       |                                                                      |                                                            |
| Green and yellow Marble...                   | Bimlipatam .....                                                     | R. O. Campbell, Esq.                                       |
| Yellow Sedimentary Clay ...                  |                                                                      |                                                            |
| Decaying Granite ... ..                      |                                                                      |                                                            |
| White Grit... ..                             |                                                                      |                                                            |
| Greenstone... ..                             |                                                                      |                                                            |
| Graphic Granite ... ..                       |                                                                      |                                                            |
| Quartz ... ..                                |                                                                      |                                                            |

| <i>Minerals.</i>                                                    | <i>Locality.</i> | <i>Forwarded by</i>                            |
|---------------------------------------------------------------------|------------------|------------------------------------------------|
| Kaolin ... ..                                                       | Bimlipatam ...   | { His Highness the Rajah of<br>Vizianagrum.    |
| White stone and Fibrolite...                                        |                  |                                                |
| Plumbago ... ..                                                     |                  |                                                |
| Micaceous Iron Ore ... ..                                           |                  |                                                |
| Antimonial Iron Ore ... ..                                          |                  |                                                |
| Sulphuret of Antimony ... ..                                        |                  |                                                |
| Garnets .. ..                                                       | Bezwarrah        | .....Captain Blagrave.                         |
| Sandstone ... ..                                                    |                  |                                                |
| Granite ... ..                                                      |                  |                                                |
| Nodular Concrete or Sep-<br>toria ... ..                            |                  |                                                |
| Kyalite ... ..                                                      | Chicacole        | .....E. Glass, Esq.                            |
| Pipe Clay ... ..                                                    | Chicacole        | .....Major Morland.                            |
| Kaolin ... ..                                                       |                  |                                                |
| Mica ... ..                                                         |                  |                                                |
| Ball Clay ... ..                                                    | Chingleput       | 12th October 1850.<br>.....Arthur Freese, Esq. |
| White Fire Clay ... ..                                              |                  |                                                |
| Grey and green Shales ... ..                                        |                  |                                                |
| (Containing Fossil Seeds)...                                        |                  |                                                |
| Marls ... ..                                                        |                  |                                                |
| Sandstones ... ..                                                   |                  |                                                |
| Bastard Fire Clay... ..                                             |                  |                                                |
| Grit and Conglomerate ... ..                                        |                  |                                                |
| Grey, White, Pink, and<br>Brown Granites and Peg-<br>matites ... .. |                  |                                                |
| Kaolin Felspar and decaying<br>Granites of several kinds...         |                  |                                                |
| Green Granite, containing<br>Copper from the... ..                  |                  | Ootramaloor Talook.                            |
| Grey Clay ... ..                                                    | Chingleput       | .....H. Cochrane, Esq.                         |
| White do . ... ..                                                   |                  |                                                |
| Yellow, Red & Brown do...                                           |                  |                                                |
| Rough white Porcelain Clay                                          | Chingleput       | ... ..A. Hunter, Esq.                          |
| Whiteish Potters' Clay ...                                          | Chingleput       | .....Moonesawmy.                               |

# MINERALS FOUND AT CHINGLEPUT IN AN EXCURSION, 14TH APRIL 1856.

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*Granites*....Pegmatite

Sienite.

Gneiss.

*Iron Ores*...Granite rich in Iron.

Quartz do.

Red and Brown Hæmatite.

Iron Glance

Slaty Iron Stone.

Magnetic Iron.

Spongy or Bag Ore.

Clay Iron Stone.

Iron Slag.

Laterite rich in Iron.

Reddle.

Iron with Manganese.

*Quartz* .....White Blue, Smoky Grey, Red and Purple.

Menelite Yellow and Grey.

Calcedony in Tabular fragments.

Brown do. with Opal.

Hornstone or Chert.

Greenstone or recent Granite, called in Madras erroneously Firestone.

Felspar, White, Pink and Grey.

Labradorite or variegated Felspar.

Felspar Gravel.

Decaying do. passing into Kaolin.

Tough Grey, Yellow and Brown Clays, formed by the decay of Granites.

Aluminous Schist formed by the decay of Pink Felspar.

True Fire Clay or Shale.

Green do.

Bastard do.

Indianite.

Zeolites in vests and druses.

Tuffaceous Lime.

Nodular do.

Yellow Marl.

| <i>Minerals.</i>                                 | <i>Locality.</i>   | <i>Forwarded by</i>                      |
|--------------------------------------------------|--------------------|------------------------------------------|
| Stealite ... ..                                  | Chittoor           | .....Dr. Chimmo.                         |
| Serpentine ... ..                                |                    |                                          |
| White Clay ... ..                                |                    |                                          |
| White Ball Clay ... ..                           | Cochin.            | ... { H. V. Conolly, Esq. (the<br>late.) |
| Kaolin and Lime (concretionary) ... ..           |                    |                                          |
| Brownish Grey Clay ... ..                        |                    |                                          |
| Yellow Clay ... ..                               |                    |                                          |
| Pebbles of Quartz ... ..                         |                    |                                          |
| White Clay ... ..                                | Conjeveram         | .....A. Freese, Esq.                     |
| Cretaceous Lime ... ..                           |                    |                                          |
| Emery ... ..                                     | Courtallum         | .....General Cullen.                     |
| Fossil Lime ... ..                               |                    |                                          |
| Petrified Sponge ... ..                          |                    |                                          |
| Asbestiform Tremolite ... ..                     |                    |                                          |
| Dark Grey Slate ... ..                           | Cuddapah.          | ....D. Mayne, Esq.                       |
| Soapstone ... ..                                 |                    |                                          |
| Lithographic Marble ... ..                       |                    |                                          |
| Indianite ... ..                                 |                    |                                          |
| Chert or Hornstone ... ..                        |                    |                                          |
| Iron Ore (Magnetic) ... ..                       |                    |                                          |
| Hæmatite... ..                                   |                    |                                          |
| Whetstone... ..                                  |                    |                                          |
| Heavy Spar or Sulphate of Baryta ... ..          |                    |                                          |
| Dolomite or grey Magnesian Lime ... ..           |                    |                                          |
| Yellow Ochre ... ..                              |                    |                                          |
| Petrified Wood ... ..                            |                    |                                          |
| Red Sandstone ... ..                             |                    |                                          |
| Purple, Yellow and Grey Sandstone ... ..         |                    |                                          |
| Galena, ... ..                                   |                    |                                          |
| Strawberry colored Sandstone ... ..              | Jungumrazpilly ... |                                          |
| Do. covered with Botryoidal ... ..               |                    |                                          |
| Manganese enclosing Rock Crystal ... ..          | Cuddapah           | .....J. Ainslie, Esq.                    |
| (This accompanies the Diamond formations) ... .. |                    |                                          |
| Iron Ore with Plumbago ... ..                    |                    |                                          |
| Plumbago .. ...                                  |                    |                                          |
| Corundum in Hexagonal Crystals ... ..            |                    |                                          |
| Do. barrel-shaped do. ... ..                     |                    |                                          |
| Do. in Pyramidal do. ... ..                      |                    |                                          |
| Do. in Tabular do. ... ..                        |                    |                                          |

| <i>Minerals.</i>                                                                                     | <i>Locality.</i>              | <i>Forwarded by</i>                           |
|------------------------------------------------------------------------------------------------------|-------------------------------|-----------------------------------------------|
| Corundum in Quadrilateral Crystals ... ..                                                            | Cuddoor<br>Nuggur Division.   | { General Cubbon.<br>Collected by Mr. Meppen. |
| Dark Adamantine Spar passing in Emery ... ..                                                         |                               |                                               |
| Adamantine Spar or Grey Tabular Corundum ... ..                                                      |                               |                                               |
| Spinel the Matrix of the Sapphire... ..                                                              |                               |                                               |
| Emery ... ..                                                                                         |                               |                                               |
| Decaying Corundum, contaminated with Lime ... ..                                                     |                               |                                               |
| Nodular Lime, containing a Crystal of Corundum ... ..                                                |                               |                                               |
| Dark Corundum in small Pyramidal Crystals ... ..                                                     |                               |                                               |
| Do. in small amorphous Crystals... ..                                                                |                               |                                               |
| Pale grey Adamantine Spar Impurities associated with Corundum, viz. Lime decaying Felspar and Iron.. |                               |                                               |
| Potstone ... ..                                                                                      | Cuddoor                       | .....C. T. Smith, Esq.                        |
| Quartz ... ..                                                                                        |                               |                                               |
| Crystalline Emery... ..                                                                              |                               |                                               |
| Petrified wood ... ..                                                                                |                               |                                               |
| Grey Shale and Sandstone...                                                                          |                               |                                               |
| Fuller's Earth ... ..                                                                                | Cuddoor                       | .....Mr. F. D. Meppen.                        |
| Blue Corundum ... ..                                                                                 |                               |                                               |
| Red do. ... ..                                                                                       |                               |                                               |
| Fibrolite ... ..                                                                                     |                               |                                               |
| Lime ... ..                                                                                          |                               |                                               |
| Chloretic Sandstone ... ..                                                                           | Dindigul                      | .....W. Cochrane, Esq.                        |
| Kaolin ... ..                                                                                        |                               |                                               |
| Chlorite Slate ... ..                                                                                |                               |                                               |
| Sandstone ... ..                                                                                     |                               |                                               |
| Mica Schist ... ..                                                                                   |                               |                                               |
| Chlorite Schist ... ..                                                                               | Doopaud, Guntoor..            | H. Hicks, Esq.                                |
| Hyalite ... ..                                                                                       |                               |                                               |
| Colored Limestones ... ..                                                                            |                               |                                               |
| Copper Ores ... ..                                                                                   |                               |                                               |
| Hæmatite ... ..                                                                                      |                               |                                               |
| Coal—very poor and slaty, probably washed down river ... ..                                          | Dowlaiswarum.....Dr. Jackson. |                                               |
| Dhobeas' Earth and Lime                                                                              | Ennore                        | .....Collected on an Excursion.               |
| Salsola and Salicornia ...                                                                           | Madras                        | .....                                         |
| Crystalline Gypsum ...                                                                               |                               |                                               |

| <i>Minerals.</i>                                                                                         | <i>Locality.</i>                          | <i>Forwarded by</i>     |
|----------------------------------------------------------------------------------------------------------|-------------------------------------------|-------------------------|
| Salt Marl and Fossils ...                                                                                | } Madras ... .. Messrs. Griffiths and Co. | Ditto.                  |
| Carbonate of Soda...                                                                                     |                                           |                         |
| Barilla ... ..                                                                                           |                                           |                         |
| Dark grey Dolomite ...                                                                                   | } Gooty—Kondoo-<br>paulpaud .....         | } Major Bissett.        |
| Black Band Iron ... ..                                                                                   |                                           |                         |
| Red Conglomerate ... ..                                                                                  |                                           |                         |
| Coarse Grit ... ..                                                                                       |                                           |                         |
| Honestone containing Iron                                                                                |                                           |                         |
| Pyrites ... ..                                                                                           |                                           |                         |
| Lithographic Stone ... ..                                                                                |                                           |                         |
| Yellow Marble ... ..                                                                                     |                                           |                         |
| Grey Conglomerate ... ..                                                                                 |                                           |                         |
| Pure Limestone with Sili-<br>ceous veins ... ..                                                          |                                           |                         |
| Black Schistose Lime ... ..                                                                              |                                           |                         |
| Light-colored Aluminous<br>Shale ... ..                                                                  |                                           |                         |
| Silicious Schist ... ..                                                                                  |                                           |                         |
| White, yellow and grey<br>Sandstones ... ..                                                              |                                           |                         |
| Mica Slate ... ..                                                                                        |                                           |                         |
| Whetstones ... ..                                                                                        |                                           |                         |
| Encrusting Concretionary<br>Lime with impressions of<br>leaves of Exogens ... ..                         |                                           |                         |
| Fossil Lime containing bones,<br>stalactites, stalagmites,<br>and impressions of recent<br>leaves ... .. |                                           |                         |
| Petroleum and Bitumen ...                                                                                |                                           |                         |
| Black Flinty Marble ... ..                                                                               | } Tarputree ... ..                        | } D. Mayne, Esq.        |
| Green Marble ... ..                                                                                      |                                           |                         |
| Pink ditto ... ..                                                                                        |                                           |                         |
| Grey and white ditto ... ..                                                                              |                                           |                         |
| Yellow ditto ... ..                                                                                      |                                           |                         |
| Sulphuret of Iron ... ..                                                                                 |                                           |                         |
| Silver Ore ... ..                                                                                        | } Kaludghee .....                         | } Lieut. A. Aytoun.     |
| Lime Stones ... ..                                                                                       |                                           |                         |
| Sandstones... ..                                                                                         |                                           |                         |
| Gold sand ... ..                                                                                         |                                           |                         |
| Galena ... ..                                                                                            | } Kurnool—Dhone }<br>Talook .....         | } A. Scott, Esq., M. D. |
| Gypsum ... ..                                                                                            |                                           |                         |
| Sulphate of Baryta ... ..                                                                                |                                           |                         |
| Lithographic Marble ... ..                                                                               |                                           |                         |
| Whetstone... ..                                                                                          |                                           |                         |
| Dendritic Manganese ... ..                                                                               | } Kurnool .....                           | } Captain Hitchens.     |
| Lithographic Stones ...                                                                                  |                                           |                         |

| <i>Minerals.</i>                                | <i>Locality.</i>                | <i>Forwarded by</i>                              |
|-------------------------------------------------|---------------------------------|--------------------------------------------------|
| Greenstone Slate ... ..                         | Lingasoogoor ...                | { Capt. S. Scott, 8th Nizam's<br>Light Infantry. |
| Jasper Porphyry ... ..                          |                                 |                                                  |
| Augite ... ..                                   |                                 |                                                  |
| Basalt ... ..                                   |                                 |                                                  |
| Granite containing Plum-<br>bago ... ..         |                                 |                                                  |
| Quartz, Felspar and Horn-<br>blende ... ..      |                                 |                                                  |
| Greenstone ... ..                               |                                 |                                                  |
| Red Felspar ... ..                              |                                 |                                                  |
| Aluminous Shale and Sand-<br>stone ... ..       |                                 |                                                  |
| Nodular Hæmatite ... ..                         |                                 |                                                  |
| Magnesian Limestone with<br>Iron Pyrites ... .. |                                 |                                                  |
| Pegmatite ... ..                                | Little Mount .....              | A. Hunter, Esq., M.D.                            |
| Decaying ditto passing into<br>Kaolin ... ..    |                                 |                                                  |
| Nodular Lime ... ..                             |                                 |                                                  |
| Grey Felspar ... ..                             |                                 |                                                  |
| Marl (Red Yellow) ... ..                        |                                 |                                                  |
| Reddle and Clay Ironstone..                     | Little Mount .....              | A. Hunter, Esq., M.D.                            |
| Blue Felspar ... ..                             |                                 |                                                  |
| Selenite and Gypsum ... ..                      | Madras .....                    | A. Hunter, Esq., M.D.                            |
| Oyster Shells partly Fossil..                   |                                 |                                                  |
| Nodular Lime and Purple<br>Marl ... ..          |                                 |                                                  |
| White Quartz in rolled<br>Pebbles ... ..        |                                 |                                                  |
| Blue Clay, Black Bitumi-<br>nous wood ... ..    |                                 |                                                  |
| Blue ball Clay ... ..                           | Mount Capper.....               |                                                  |
| Blue Limewith Fossil Shells.                    | Cuddalore .....                 | Captain Leggatt.                                 |
| Red Conglomerate and Sand-<br>stones .. ..      |                                 |                                                  |
| Tourmaline ... ..                               | Bed of the Ma-<br>hanuddy ..... | Colonel McCally.                                 |
| Cinnamon Stone ... ..                           |                                 |                                                  |
| Felspar ... ..                                  |                                 |                                                  |
| Prase, Jasper, Amethyst,<br>Quartz ... ..       |                                 |                                                  |
| Rock Crystal Cornelian                          |                                 |                                                  |
| Agate ... ..                                    |                                 |                                                  |
| Calcedony, Porphyry, Por-<br>celain ... ..      |                                 |                                                  |
| Jasper Red, Yellow and<br>Brown Jasper ... ..   |                                 |                                                  |
| Mica Schist ... ..                              | July 1849.                      |                                                  |
| Sandstone ... ..                                | Masulipatam .....               | Captain Applegath.                               |
| Marble ... ..                                   |                                 |                                                  |
| Slate ... ..                                    |                                 |                                                  |

| <i>Minerals.</i>                                                               | <i>Locality.</i>              | <i>Forwarded by</i>      |
|--------------------------------------------------------------------------------|-------------------------------|--------------------------|
| Albite or White Felspar ...                                                    | Masulipatam                   | .....Dr. Stanbrough.     |
| Steatite ... ..                                                                |                               |                          |
| Magnesian Lime ... ..                                                          | Masulipatam                   | .....Captain Applegath.  |
| Lithographic Marble ... ..                                                     |                               |                          |
| Argillaceous Schist ... ..                                                     |                               |                          |
| Red Sandstone ... ..                                                           |                               |                          |
| Grey soft Aluminous Shale..                                                    |                               |                          |
| Grey Limestone ... ..                                                          |                               |                          |
| Conglomerate .. ..                                                             | .....                         | .....Captain Blgrave.    |
| Felspar ... ..                                                                 |                               |                          |
| Granite ... ..                                                                 |                               |                          |
| Lithomarge ... ..                                                              |                               |                          |
| Hæmatite ... ..                                                                | Mysore                        | .....Mr. H. Smith.       |
| Garnets ... ..                                                                 |                               |                          |
| Iron Ores, Magnetic do. ...                                                    | Mysore — Chin-<br>napatam ... | } Captain Elliot.        |
| Do. containing Manganese..                                                     |                               |                          |
| Sandstone containing Iron<br>used in making steel                              |                               |                          |
| wire ... ..                                                                    |                               |                          |
| Sesquioxide of Manganese...                                                    |                               |                          |
| Black Band Iron in Sand-<br>stone ... ..                                       | Nuggur                        | .... Mr. H. Smith.       |
| Manganese and Iron ...                                                         |                               |                          |
| Corundum ... ..                                                                | Nellore                       | .....F. H. Crozier, Esq. |
| Red Ochrey Micaceous earth<br>used as a varnish with<br>wood oil ... ..        |                               |                          |
| Mica Schist ... ..                                                             |                               |                          |
| Limpid, Quartz, Amethys-<br>tine do. Rock Crystal ...                          |                               |                          |
| Buff or cream colored Ochre.                                                   |                               |                          |
| Tripoli, Red and Lavender<br>colored sandstones .....                          |                               |                          |
| Polier Slate resembles the<br>Sandstone from Alumbay,<br>Isle of Wight ... ..  |                               |                          |
| Fine-grained green Sand-<br>stone, a Whetstone that<br>accompanies Corundum... |                               |                          |
| Kaolin ... ..                                                                  |                               |                          |
| Nodular Blue Limestone<br>(Hydraulic) ... ..                                   |                               |                          |
| Decaying Granites ... ..                                                       |                               |                          |
| Earthy Limestone and coarse<br>Concrete... ..                                  |                               |                          |
| Crystalline Augite... ..                                                       |                               |                          |
| Calcareous Spar ... ..                                                         |                               |                          |
| Garnet Aplome ditto ...                                                        |                               |                          |

| <i>Minerals.</i>                                                           | <i>Locality.</i>                    | <i>Forwarded by</i>         |
|----------------------------------------------------------------------------|-------------------------------------|-----------------------------|
| Emery, Crystalline and Tabular ... ..                                      |                                     |                             |
| Iron Ore, Specular ditto ... ..                                            |                                     |                             |
| Schorl massive ... ..                                                      |                                     |                             |
| Grey Steel Sand ... ..                                                     |                                     |                             |
| Black Sandstone impregnated with Iron, makes good steel ... ..             |                                     |                             |
| Jet-black Sand containing Iron and Manganese ... ..                        |                                     |                             |
| Granites, Palegrey { Quartz, or Sienite { Felspar composed of ..... & Mica | Nellore                             | ... F. H. Crozier, Esq.     |
| Yellowish Pegmatite { Quartz and composed of ..... Felspar                 |                                     |                             |
| Lepidolite { Mica and composed of Quartz of ..... Mica & Hornblende.       |                                     |                             |
| Gneiss ... ..                                                              |                                     |                             |
| Heavy spar ... ..                                                          |                                     |                             |
| Fibrous Gypsum ... ..                                                      |                                     |                             |
| Chert or Hornstone ... ..                                                  | Sydapoor Talook.                    |                             |
| Mica Slate and Schist ... ..                                               | Woodiagherry do.                    |                             |
| Earthy Chlorite ... ..                                                     |                                     |                             |
| Chlorite Slate ... ..                                                      |                                     |                             |
| Compact Sandstone ... ..                                                   |                                     |                             |
| Copper Ore ... ..                                                          | Tada Talook.                        |                             |
| Sandstones ... ..                                                          |                                     |                             |
| Fire Clay ... ..                                                           |                                     |                             |
| Clay Ironstone ... ..                                                      | Nellore, Podde-<br>lay Talook ... } | D. White, Esq.              |
| Slaty Black Shale... ..                                                    |                                     |                             |
| Black Sandstone ... ..                                                     |                                     |                             |
| Copper Ore... ..                                                           | Tada Talook.                        |                             |
| Granular white Marble ... ..                                               | Nagpore and<br>Jubbulpore .... }    | Rev. S. Hialop.             |
| Coal ... ..                                                                |                                     |                             |
| Sandstone ... ..                                                           |                                     |                             |
| Hæmatite ... ..                                                            | Neilgherries                        | .....Captain Molyneux.      |
| Laterite ... ..                                                            |                                     |                             |
| Ferruginous Sand ... ..                                                    |                                     |                             |
| Pisi form Iron Ore ... ..                                                  |                                     |                             |
| Kaolin ... ..                                                              |                                     |                             |
| Umber ... ..                                                               |                                     |                             |
| Iron Ore Magnetic... ..                                                    | Ongole                              | .....Frederick Nelson, Esq. |
| Brown Hæmatite... ..                                                       |                                     |                             |

| <i>Minerals.</i>                                      | <i>Locality.</i>                        | <i>Forwarded by</i>                |
|-------------------------------------------------------|-----------------------------------------|------------------------------------|
| Fibrous Gypsum ... ..                                 | August 1849.<br>Ootatoor                | Major Lawford.                     |
| Selenite ... ..                                       |                                         |                                    |
| Magnesian Lime Sandstone..                            | Ootatoor                                | Rickets, Esq.                      |
| Fibrous, Gypsum & Fossils..                           |                                         |                                    |
| Sulphate of Baryta ... ..                             |                                         |                                    |
| Ball Clay ... ..                                      | Poonamallee                             | James Forlong, Esq.                |
| Gypsum in thin Seams ... ..                           |                                         |                                    |
| Grey Ball Clay ... ..                                 | Paupantangulum...                       | Gunner T. Barton.                  |
| Agates and Pebbles ... ..                             | Rajahmundry ...                         | { Major F. Cotton.<br>Dr. Ranking. |
| Petrified Wood ... ..                                 |                                         |                                    |
| Sandstones... ..                                      |                                         |                                    |
| Iron stone ... ..                                     |                                         |                                    |
| Granular green Felspar re-<br>sembling Turkey Hone... |                                         |                                    |
| New Sandstone, yellow and<br>red ... ..               |                                         |                                    |
| Mica Schist ... ..                                    |                                         |                                    |
| Ochre ... ..                                          |                                         |                                    |
| Dark Red coarse Sandstone..                           |                                         |                                    |
| Chlorite Schist ... ..                                |                                         |                                    |
| Diamond Breccia ... ..                                |                                         |                                    |
| Ferruginous Conglomerates.                            |                                         |                                    |
| Mountain Lime ... ..                                  |                                         |                                    |
| Quartz ... ..                                         |                                         |                                    |
| Ruby and Amber-colored<br>Quartz ... ..               |                                         |                                    |
| Porphyry ... ..                                       |                                         |                                    |
| Porcelain Clays and Kaolin.                           |                                         |                                    |
| Septariæ ... ..                                       |                                         |                                    |
| White Ball Clay ... ..                                | Railway cuttings }<br>near Avady... }   | A. H. McNair, Esq.                 |
| Red Marl, Grey ditto ... ..                           |                                         |                                    |
| Dark Ochre ... ..                                     |                                         |                                    |
| Septariæ ... ..                                       |                                         |                                    |
| Coarse Sandstone ... ..                               |                                         |                                    |
| Granite decaying ... ..                               |                                         |                                    |
| Menelite ... ..                                       |                                         |                                    |
| Soft Grit ... ..                                      |                                         |                                    |
| Jasper (Flinty) ... ..                                |                                         |                                    |
| Jaspery Clay Iron Stone ...                           | Do. near Triva- }<br>toor, Juliapett. } | Allan Wilson, Esq.                 |
| Flint ... ..                                          |                                         |                                    |
| Aluminous Shale ... ..                                |                                         |                                    |
| Decaying Felspar ... ..                               |                                         |                                    |
| Fossil Seeds from green Clay                          |                                         |                                    |
| Micaceous Sandstone ... ..                            |                                         |                                    |
| Dark-red Aluminous Shale..                            |                                         |                                    |
| Pink Felspar ... ..                                   |                                         |                                    |

| <i>Minerals.</i>                              | <i>Locality.</i>                             | <i>Forwarded by</i>          |
|-----------------------------------------------|----------------------------------------------|------------------------------|
| Grey Ball Clay ... ..                         | Red Hills .....                              |                              |
| Magnesian Clay ... ..                         |                                              |                              |
| Yellow Marl ... ..                            |                                              |                              |
| Red Sandstone ... ..                          |                                              |                              |
| Coarse Conglomerate ... ..                    |                                              |                              |
| Decaying Soapstone ... ..                     |                                              |                              |
| Brown Jaspery Clay, Iron stone ... ..         |                                              |                              |
| Albite ... ..                                 | Salem .....                                  | Rev. J. M. Lechler.          |
| Iron Ores ... ..                              |                                              |                              |
| Plumbago ... ..                               |                                              |                              |
| Petrified wood ... ..                         |                                              |                              |
| Indurated Talc ... ..                         |                                              |                              |
| Magnesite ... ..                              |                                              |                              |
| Woodopal ' ... ..                             | Shevaroy Hills.....                          | J. Johnstone, Esq.           |
| Quartz ... ..                                 | Sidhout .....                                | D. Mayne, Esq.               |
| Aluminous Slate ... ..                        |                                              |                              |
| Sulphate of Baryta ... ..                     |                                              |                              |
| Iron Pyrites ... ..                           |                                              |                              |
| Galena ... ..                                 | At Jungunrazpilly..                          |                              |
| Fire Clay ... ..                              | Streepermatoor...                            | Gunner T. Barton.            |
| Tough grey Clay .....                         |                                              |                              |
| Petrified Wood (white Al-<br>buminous) ... .. |                                              |                              |
| Shales white, grey and green                  |                                              |                              |
| Red Clay ... ..                               |                                              |                              |
| Yellow do. ... ..                             |                                              |                              |
| Sandstone ... ..                              |                                              |                              |
| Petrified Wood (Silicious)...                 |                                              |                              |
| Grit and Conglomerate ... ..                  |                                              |                              |
| Iron Clay ... ..                              |                                              |                              |
| Fire Clay ... ..                              | Do.....                                      | Thasildar of Streepermatoor. |
| Nodular Lime ... ..                           | St. Thomas' Mount.....                       | Capt. Dansey.                |
| Yellowish Marl ... ..                         |                                              |                              |
| (Slightly Hydraulic)                          |                                              |                              |
| Nodular Lime ... ..                           |                                              |                              |
| Red and Yellow Marl ... ..                    |                                              |                              |
| Fibrous Gypsum ... ..                         | Scinde and the shores of the Persian Gulf... | Dr. Buist.                   |
| Granular do. ... ..                           |                                              |                              |
| Selenite ... ..                               |                                              |                              |
| Land Salt ... ..                              |                                              |                              |
| Magnetic Iron Ore ... ..                      | Travancore.....                              | Genl. Cullen.                |
| Sienite with Copper ... ..                    |                                              |                              |
| Garnet ... ..                                 |                                              |                              |
| Apatite ... ..                                |                                              |                              |
| Asparagus Stone ... ..                        |                                              |                              |
| Corundum ... ..                               |                                              |                              |

| <i>Minerals.</i>                                | <i>Locality.</i> | <i>Forwarded by</i> |
|-------------------------------------------------|------------------|---------------------|
| Fibrous Gypsum ...                              | Tiagar.....      | H. Wood, Esq.       |
| White Crystalline Lime ...                      | Tinnevelly.....  | C. J. Bird, Esq.    |
| Calcareous Spar ...                             |                  |                     |
| Fine Granular Marble ...                        |                  |                     |
| Kaolin ...                                      | Vizianagrum..... | F. H. Crozier, Esq. |
| Felspar Moonstone ...                           |                  |                     |
| Cleavelandite ...                               |                  |                     |
| Hyalite red and blue Quartz                     |                  |                     |
| Rock Crystal Amethyst ...                       |                  |                     |
| Mica ...                                        |                  |                     |
| Garnet—Schorl... ..                             |                  |                     |
| Plumbago—Oxide of Iron...                       |                  |                     |
| Porphyry ...                                    | Vizianagrum..... | F. H. Crozier, Esq. |
| Iron Ore and Clay Ironstone }                   |                  |                     |
| Pink Felspar ...                                |                  |                     |
| Mica and Lepidolite ...                         |                  |                     |
| Iron Glance ...                                 |                  |                     |
| Granite containing Tourmaline and Garnets ... } |                  |                     |
| Plumbago ...                                    | Vizianagrum..... | F. H. Crozier, Esq. |
| Cleavelandite ...                               |                  |                     |
| Kunkur ...                                      |                  |                     |
| Dolomite ...                                    |                  |                     |
| Blue compact Limestone ... }                    |                  |                     |

BANKS OF THE GODAVERY, FIRST EXPLORATION UNDER  
LIEUT. HAIG.

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*Contributed by Dr. Jackson.*

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Green stone slaty in Fracture.  
Crystalline Augite and Quartz.  
Chlorite Slate.  
Quartz, containing large Crystals of Schorl.  
Gneiss.  
Blue smoky Quartz, containing Crystals of Cinnamon stone.  
Asparagus, Stone and Quartz.  
Coarse Plasma or greenish Quartz.  
Coarse Lepidolite or Quartz and Mica.  
Red Sandstone, containing much Iron.  
Greenstone Slate.  
Quartz traversing a Vein of Mica Slate.  
Purple Sandstone, containing much Iron.  
Pink Porphyry.  
Cellular Iron Ore.  
Iron Glance.  
Quartz of a Hyacinth colour.  
Decaying Pegmatite or Binary Granite.  
Granite, containing coarse Garnets.  
Whitestone Albite or white Felspar.  
White Pegmatite or Binary Granite.  
Quartz with Crystalline Augite.  
Fresh compact Pink Felspar.  
Decaying Granite.  
Mica Slate.  
Stalatic Iron Ore, with a large proportion of Manganese.  
Fragment of a Petrified Tree.  
Mica Schist, containing decayed Felspar.  
Micaceous Sandstone.  
Fragment of a radiated Zeolite.  
Rolled Piece of soft Sandstone.  
Pink Pegmatite or Binary Granite.

## SUMMARY OF PREVIOUS LIST.

| <i>Locality.</i> | <i>Class of Formations.</i>                                                                            | <i>Remarks.</i>                                                                                                                                                   |
|------------------|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ARCOT.....       | Primitive.<br>Decaying do.<br>Sedimentary and Alluvial deposits.                                       | Materials for Porcelain and glass abundant.<br>Iron Ores of good quality.                                                                                         |
| ARNEE.....       | Primitive with transition.                                                                             | Good whetstone and sharpening stone found in bed of river.                                                                                                        |
| BANGALORE.....   | Primitive.<br>Decaying do.<br>Recent Granites of 3 periods.<br>Transition Rocks and Alluvial deposits. | Materials for Porcelain Pottery and Glass very abundant.<br>Colored earths plentiful.                                                                             |
| BELLARY.....     | Primitive.<br>Transition.<br>Old Secondary and Alluvial deposits.                                      | Gems in beds of Kistnah and Tamboodra.<br>Metallic Ores very abundant.<br>Sharpening stones.<br>Polishing Powders and colored earths abundant.<br>Lime plentiful. |
| BIMLIPATAM.....  | Primitive.<br>Alluvial deposits.                                                                       | Porcelain materials abundant.<br>Ores of Iron, Antimony and Manganese plentiful.                                                                                  |
| BEEWARAH.....    | Primitive.<br>Transition and Alluvial deposits.                                                        | Garnets plentiful.<br>Sandstones and Hydraulic lime abundant.                                                                                                     |
| CHICACOLE.....   | Primitive.<br>Decaying do.                                                                             | Porcelain materials very fine.                                                                                                                                    |

| <i>Locality.</i>                                 | <i>Class of Formation.</i>                                                                               | <i>Remarks.</i>                                                                                                                                                                                                                                 |
|--------------------------------------------------|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CHINGLEPUT.....                                  | Primitive.<br>Decaying do.<br>Granites of 3 distinct periods.<br>Recent Tertiary and Al-luvial deposits. | Materials for Pottery and Glass very abundant.<br>Rich Ores of Iron and Manganese.<br>Colored earths.                                                                                                                                           |
| CHITTOOR... ..                                   | Primitive and decaying do,                                                                               | Magnesian Minerals and colored Granites abundant.                                                                                                                                                                                               |
| COCHIN.....                                      | Decaying Primitive and Sedimentary deposits.                                                             | Good Porcelain Materials                                                                                                                                                                                                                        |
| CONJEVERAM... ..                                 | Sedimentary deposits.                                                                                    | Good Potters' Clay and Chalky Lime.                                                                                                                                                                                                             |
| COURTALLUM.....                                  | Primitive and Tertiary.                                                                                  | Emery of fine quality.<br>Fossil zoophites.                                                                                                                                                                                                     |
| CUDDAPAH... ..                                   | Primitive of 2 periods.<br>Transition.<br>Old Secondary.<br>Recent Tertiary and Al-luvial deposits.      | Materials for Porcelain and Pottery abundant.<br>Whetstones, Hones, Slates and Grindstones very plentiful.<br><br>Colored earths and fine Polishing Powders.<br><br>Corundum, Gems, Marl and Mountain.<br><br>Limestones rich in Metallic Ores. |
| CUDDOOR.....<br>(NUGGUR DIVI-<br>SION OF MYSORE) | Primitive and tran-sition.                                                                               | Corundum.<br>Emery and Sandstones plentiful.<br><br>Fullers earth.                                                                                                                                                                              |
| DINDIGUL... ..                                   | Decaying primitive.                                                                                      | Very fine Porcelain earth.                                                                                                                                                                                                                      |
| DOOPAID IN GUN-<br>TOOR... ..                    | Transition.                                                                                              | Whetstones and Magne-sian Limestones with Metallic ores.                                                                                                                                                                                        |

| <i>Locality.</i>    | <i>Class of Formation.</i>                                      | <i>Remarks.</i>                                                                                                                               |
|---------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| ENNORE.....         | Alluvial deposits.<br>Gypsum formations.                        | Crystals of Selenite and<br>Gypsum, Barilla and<br>Sea Salt.<br>Fossils Shells.<br>Black Marl with Sulphur.                                   |
| GOOTY.....          | Transition.<br>Secondary.<br>Tertiary? or Alluvial<br>deposits. | Mountain Lime with Me-<br>tallic veins, conglome-<br>rates.<br>Marbles, Whetstones.<br>Grindstones.<br>Fossil Lime.<br>Bitumen and Petroleum. |
| DO. TO CARPUTREE... | Transition.                                                     | Chert and Black Marble.                                                                                                                       |
| DO. TO RYELCHEROO.. | Secondary.                                                      | Colored Marbles.<br>Slates, Whetstones.<br>Grindstones very plenti-<br>ful.                                                                   |
| KALUDGEE.....       | Primitive.<br>Transition.                                       | Gold dust.<br>Silver Ore.<br>Limestones.<br>Sandstones.                                                                                       |
| KURNOOL.....        | Secondary.                                                      | Magnesian Limestones.<br>Lithographic stones.<br>Whetstones.                                                                                  |
| D. DHONEE TALOOK..  |                                                                 | Galena.<br>Gypsum and Heavy spar.                                                                                                             |
| LINGASOOGOOR....    | Primitive and Transi-<br>tion.                                  | Ornamental Jasper and<br>Porphyry in large blocks,<br>Magnesian Lime and<br>Sandstone.                                                        |
| LITTLE MOUNT.....   | Decaying primitive.                                             | Materials for Pottery and<br>Marly Limestone.                                                                                                 |
| MADRAS.....         | Sedimentary deposits.                                           | Blue Clay.<br>Nodular Lime.<br>Gypsum and Fossils.<br>Black Bituminous wood.                                                                  |

| <i>Locality.</i>                   | <i>Class of Formations.</i>                                              | <i>Remarks.</i>                                                                                                                                    |
|------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| MOUNT CAPPER<br>NEAR CUDDALORE     | Recent Tertiary.                                                         | A good Clay for Pottery<br>abundant.                                                                                                               |
| BED OF THE RIVER<br>MAHANUDDY. ... | Primitive.                                                               | Gems and Pebbles.                                                                                                                                  |
| MASULIPATAM.....                   | Primitive.<br>Transition and Secon-<br>dary with Alluvial de-<br>posits. | Materials for Porcelain<br>Grey and Magnesian<br>Marbles.<br>Slates and Sandstones.                                                                |
| MYSORE.....                        | Primitive.                                                               | Garnets.<br>Iron Ore.<br>Whetstones.                                                                                                               |
| NUGGUR.....                        | Primitive.                                                               | Iron Ores and Corundum.                                                                                                                            |
| NELLORE... ..                      | Primitive.<br>Decaying do.<br>Transition.<br>Alluvial deposits.          | Materials for Porcelain.<br>Sandstones.<br>Whetstones and Polishing<br>Slates.<br>Emery and Garnets.<br>Colored Granites.<br>Iron and Copper Ores. |
| NAGPORE AND JUB-<br>BULPORE... ..  | Secondary<br>Oolitic.                                                    | Sandstone.<br>Coal Magnesian.<br>Limestone Slate.<br>Statuary Marble.<br>Alabaster.                                                                |
| NEILGHERRIES... ..                 | Primitive Rocks.<br>Alluvial deposits.                                   | Porcelain Materials.<br>Colored earths, Umber and<br>Metallic Ores.                                                                                |
| ONGOLE.....                        | Alluvial deposits.                                                       | Iron Ores and Hæma-<br>tites.                                                                                                                      |
| OOTATOOR NEAR<br>TRICHINOPOLY...   | Secondary<br>Greensand.                                                  | Gypsum Sandstone.<br>Red and Purple.<br>Marl Conglomerate.<br>Heavy Spar.                                                                          |

| <i>Locality.</i>                                        | <i>Class of Formation.</i>           | <i>Remarks.</i>                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OOTATOOR.....                                           | Greensand.                           | Fossils.<br>Ammonites.<br>Gigantic do.<br>Orthoceratites.<br>Scaphites Ammonoceras.<br>Lituites Baculites.<br>Hamites Trioceratites.<br>Turrilites Orlenlites.<br>Nautilites Bellerophan.<br>Belemnites Mytilus.<br>Coprolites.<br>Sepataria.<br>Bones of large reptile<br>(Ignanodan ?)<br>Fossil Trees Endogenous<br>and Exogenous. |
| POONAMALLEE.....                                        | Alluvial deposits.                   | Potters' Clay abundant.                                                                                                                                                                                                                                                                                                               |
| AND PAPANTANGU-<br>LUM IN THE CHIN-<br>GLEPUT DISTRICT. |                                      |                                                                                                                                                                                                                                                                                                                                       |
| RAJAHMUNDREY.....                                       | Primitive.                           | Pebbles.                                                                                                                                                                                                                                                                                                                              |
|                                                         | Transition and Alluvial<br>deposits. | Sandstones.<br>Conglomerate.<br>Diamond Brellia.<br>Iron Ores.<br>Septaria.                                                                                                                                                                                                                                                           |
| RAILWAY CUTTINGS...                                     | Alluvial deposits.                   | Potters' Clay.                                                                                                                                                                                                                                                                                                                        |
| NEAR AVADY AND<br>JULIAPETT.                            |                                      | Lime.<br>Marl.<br>Grit and Shales.                                                                                                                                                                                                                                                                                                    |
| RED HILLS NEAR<br>MADRAS.                               | Alluvial deposits.                   | Potters' Clay and Marl.<br>Red Conglomerate.<br>Sandstone and Ochres.                                                                                                                                                                                                                                                                 |

| <i>Locality.</i>            | <i>Class of Formation.</i>                | <i>Remarks.</i>                                                                                                |
|-----------------------------|-------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| SALEM.....                  | Primitive and Alluvial deposits.          | Materials for Porcelain very abundant.<br>Rich Ores of Iron and Chrome.<br>Corundum and Emery of good quality. |
| SHEVAROY HILLS...           | Probably Tertiary.                        | Fossil wood and wood Opal.                                                                                     |
| SIDHOUT AND JUNGUNRAZPILLY. | Primitive and Transition.                 | Aluminous Slate with Iron Pyrites.<br>Heavy Spar.<br>Galena with Silver.                                       |
| STREEPERMATOOR....          | Probably Tertiary and Alluvial deposits.  | Fire Clay Sandstones, Shales with Fossil wood leaves and seeds.                                                |
| ST. THOS.'s MOUNT....       | Alluvial deposits and Primitive Granites. | Lime and Marl.                                                                                                 |

ALEX. HUNTER, M.D.,  
*In charge Madras School of  
Industrial Arts.*

1st November 1856.

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FROM SURGEON E. BALFOUR, THE OFFICER IN CHARGE OF THE  
GOVERNMENT CENTRAL MUSEUM.

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MR. EDWARD BALFOUR expresses his regret that, circumstances prevent his aiding in the completion of the corrections of the late Mr. Greenough's Geological Map of India.

MADRAS,                                 }                                 EDWARD BALFOUR.  
10th August 1857. }

To

D. F. CARMICHAEL, ESQUIRE,  
*Deputy Secretary to Government,  
Fort St. George.*



